S. HRG. 108–757

REPORT OF THE U.S. COMMISSION ON OCEAN POLICY

HEARINGS

BEFORE THE

SUBCOMMITTEE ON COMMERCE, JUSTICE, AND STATE, THE JUDICIARY, AND RELATED AGENCIES

AND THE

COMMITTEE ON APPROPRIATIONS
UNITED STATES SENATE

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SECOND SESSION

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CONTENTS

THURSDAY, APRIL 22, 2004

	Page
Statement of Admiral James D. Watkins, U.S. Navy (Ret.), Chairman, U.S. Commission on Ocean Policy	1
Accompanied by:	
Ed Rasmuson, Member, U.S. Commission on Ocean Policy	1
Paul A. Sandifer, Ph.D., Member, U.S. Commission on Ocean Policy; and Senior Scientist, National Centers for Coastal Ocean Science, National Ocean Service, National Oceanic and Atmospheric Administration	1
Andrew A. Rosenberg, Ph.D., Member, U.S. Commission on Ocean Policy; and Professor, University of New Hampshire	1
Thomas Kitsos, Executive Director, U.S. Commission on Ocean Policy	1
Call to Action	3
National Ocean Policy Framework	3
President's Council of Advisors on Ocean Policy	4
Regional Ocean Councils	5
Offshore Management Regime	5
Strengthening the Federal Agency Structure	5
Ocean Policy Trust Fund	6
Prepared Statement of Admiral James D. Watkins	8
The Value of the Oceans and Coasts	8
Trouble in Paradise	9
Vision and Strategy for the 21st Century	9
Improving Governance	11
Science-based Decisions: Advancing Our Understanding of the Oceans	17
Promoting Lifelong Ocean Education	23
Specific Management Challenges	28
Improving Management of Coasts and Watersheds	28
Coastal and Ocean Water Quality	33
Enhancing the Use and Protection of Ocean Resources	37
Advancing International Ocean Science and Policy	43
Implementing a New National Ocean Policy	44

MONDAY, SEPTEMBER 27, 2004

Statement of Ann Weaver Hart, President, University of New Hampshire	59
Statement of Robert Ballard, Ph.D., Member, U.S. Commission on Ocean Policy; and Professor, University of Rhode Island	62
Prepared Statement of	66
Statement of Paul A. Sandifer, Ph.D., Member, U.S. Commission on Ocean Policy; and Senior Scientist, National Centers for Coastal Ocean Science, National Ocean Service, National Oceanic and Atmospheric Administration	67
Prepared Statement of	70
Statement of Andrew A. Rosenberg, Ph.D., Member, U.S. Commission on Ocean Policy; and Professor, University of New Hampshire	77
Prepared Statement of	80

REPORT OF THE U.S. COMMISSION ON OCEAN POLICY

THURSDAY, APRIL 22, 2004

U.S. SENATE,
COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The committee met at 2:03 p.m., in room SD–138, Dirksen Senate Office Building, Hon. Judd Gregg presiding.

Present: Senators Stevens, Cochran, Gregg, Burns, and Leahy.

STATEMENT OF ADMIRAL JAMES D. WATKINS, U.S. NAVY (Ret.), CHAIRMAN, U.S. COMMISSION ON OCEAN POLICY

ACCOMPANIED BY:

ED RASMUSON, MEMBER, U.S. COMMISSION ON OCEAN POLICY

PAUL A. SANDIFER, Ph.D., MEMBER, U.S. COMMISSION ON OCEAN POLICY; AND SENIOR SCIENTIST, NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE, NATIONAL OCEAN SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANDREW A. ROSENBERG, Ph.D., MEMBER, U.S. COMMISSION ON OCEAN POLICY; AND PROFESSOR, UNIVERSITY OF NEW HAMPSHIRE

THOMAS KITSOS, EXECUTIVE DIRECTOR, U.S. COMMISSION ON OCEAN POLICY

Senator GREGG. We are going to begin the hearing. The chairman of the full committee will be here, and we are expecting Senator Hollings.

The hearing today is on the issue of the oceans and we have a report from Admiral Watkins and the U.S. Commission on Ocean Policy. It is the first major review of Federal ocean policy and programs in probably 35 years. It has the imprimatur of the Government on it. Its purpose was to give us an assessment of where we are in ocean policy and where we should go. I want to congratulate the Commission for doing an extraordinary job. I have had a chance to read it, look at and study it in some depth, and I am very impressed with the product. I have issues and concerns obviously, as anybody would, because there are so many issues involved.

But as we all know, the ocean is such a key part of our environment, our economy, our society, our definition of ourselves, that having a coordinated and intelligent and thoughtful policy on it is critical. I want to congratulate the Commission for putting a proposal forward that we as a Congress can use as a road map.

I think it was Arthur C. Clarke who said, and I quoted him a couple of days ago, that instead of planet Earth, we should call our planet "planet ocean" because so much of it is ocean. And we now

know that most of the ocean has not been explored. We are off to Mars to try to explore it and find water; however, we do not even know what is in the water off our shores. I think it is about time we focussed on that. What this Commission does is give us guideposts for how we can accomplish that effectively.

And Senator Stevens is here so I will turn it over to the chairman.

Chairman STEVENS. Thank you for coming. It has been a full day for you and it is a fuller day for us running back and forth, I will tell you, but we thought we ought to have this hearing so that we had on the record and clearly delineated the enormous concepts that are in your report and how they will affect this committee because the estimates of the additional costs of the recommendations you have made to the Federal Government I understand will be at least $1.273 billion in the first year, $2.318 billion in the second year, and level off somewhere around $3.192 billion in the years thereafter.

Now that is an enormous increase and I spent this morning with the NIH people; they are seeking another increase. There is not a section of the Government that is not seeking an increase to meet the technological challenges that they face. The National Science Foundation, all of them legitimately request additional amounts of money.

We currently have programs in the area that you are dealing with and in 2001 alone—that is the latest figure I could grab together—was $8.3 billion and NOAA represented $1.6 billion of that total.

So your comments we welcome and certainly there is no question that we support but the real problem is going to be to find the commitment for not only the Congress but for the administration to get behind this report from the point of view of commitment of dollars on a steady basis so we know what we are dealing with.

I do want to thank once more my good friend Ed Rasmuson. He has discussed with me some of the problems involved here, particularly the pollution problem, and we have to be—I think you said we wanted a policy of no sewage left behind.

Mr. RASMUSON. Yes.

Chairman STEVENS. So we here, some of us are members of both committees and we want to assist to the maximum extent possible and thank you all for being here.

Senator Gregg, you are the chair of this committee.

Senator GREGG. Thank you, Mr. Chairman.

Senator Burns.

Senator BURNS. Thank you, Mr. Chairman.

I have no statement, although I have quite a lot of interest on how we approach this and I want to thank the Commission. From what we have seen, and I have not read the entire report, you have done really good work and I congratulate you on that.

We are watching and I am concerned, like the chairman of the full committee is concerned, about what commitment we get out of Congress and from the administration on some of the things that we must address—I feel like they must be addressed—and how we fund those things in a way that has some predictability about it.

So I thank you for your work and I will be interested more in your testimony today. Thank you for coming and thank you, Mr. Chairman.

Senator GREGG. I thank the chairman of the full committee. I understand he has to come and go, but I do intend to be here for the full hearing. The subcommittee which I chair, which Senator Hollings is the ranking member of, does have jurisdiction over NOAA, which receives a lot amount of the attention in this report. Therefore, we are very interested in your thoughts in that area.

Admiral Watkins, we would love to have you make a presentation in any form you want to make it. I would note we do have a vote scheduled for 2:45–2:50, which does put some time restraints on us.

Admiral WATKINS. Thank you, Mr. Chairman. In deference to Senator Stevens, who heard this 10-minute oral statement this morning, I do not think he could live through another one of those so what I would like to do is ask you if you would take my oral statement, put it in the record so we can cut the time down at the front end and have more time for discussion during the next 40 minutes.

Senator GREGG. Of course, we would be happy to do that.

Admiral WATKINS. Let me start out with the very bottom line of our morning statement to the Commerce Committee. As a specific call to action for the United States Senate, we believe it is critical for the following actions to occur as soon as possible. This obviously relates to our preliminary report recommendations.

CALL TO ACTION

First, authorize the establishment in the Executive Office of the President, a National Ocean Council, a President's Council of Advisors on Ocean Policy, and an Office of Ocean Policy, and I will expand on that in a minute.

Second, enact an organic act for NOAA. We believe it is critical for NOAA to come into the modern world of ecosystem-based management. The agency is not configured in that way now and it needs to restructure itself in a more powerful way. Then we want to give NOAA many new responsibilities, like running the integrated ocean observing system, a component of what it looks like the President is now going to commit to—an Earth-observing system.

And third, create an Ocean Policy Trust Fund, which obviously had some controversy at the prior committee hearing this morning. We would like to discuss that in great depth and I have asked the Executive Director of the Commission, the former Acting Director of the Minerals Management Service in Interior, who is an expert in dealing with offshore oil revenues, to be at the table here to answer some questions I know that this committee is going to be interested in.

NATIONAL OCEAN POLICY FRAMEWORK

So let me talk about the first item, which is the establishment of the National Ocean Council (NCO) in the executive branch. The National Ocean Council is composed of Cabinet secretaries and heads of independent agencies with ocean-related responsibilities.

The NOC would be responsible for coordinating Federal ocean activities. Today there are 15 departments and independent agencies that have functions related to the oceans and we have outlined them in tabular form in one of our figures in the report. There is much redundancy, overlap, and failure to collaborate with each other on issues of common interest for a variety of reasons. I am not condemning them. That is just the way the system works. It is a vertically oriented, standpipe structure. They are mission-oriented agencies. They come before 60 committees of the House and Senate dealing with matters in ocean policy across the board, 44 alone for science and technology. So there are a lot of reasons why it is a Byzantine network today and does not work.

At any rate, we are saying there should be a head on this unruly network. We believe the National Ocean Council should be headed up by a representative of the President, which we designate as an assistant to the President. We do not specify which assistant to the President should lead the NOC, it can be the Council of Economic Advisers. It could be the head of the Domestic Policy Council. It can be anybody, but he or she needs to hear from the President: "I want to do something about the oceans."

That will give the OMB Director the signal to move. He can coordinate through this National Ocean Council an integrated budget submission that can be viewed as a package. How are we going to implement the integrated ocean observing system? Well, the Interior Department is going to have some part of it, EPA is going to have some part of it, Navy is going to have some part of it. Almost every agency that we have outlined in our report is going to have a piece of that and they should come together in a seamless web, horizontally integrated. This could be done through a modified National Ocean Partnership Program, which has already been established by the Congress.

So there are ways to make this work without bringing the Secretary of Defense himself to the table and we believe that the Assistant to the President has that power if the President wants to do it.

PRESIDENT'S COUNCIL OF ADVISORS ON OCEAN POLICY

We have also said that there should be a President's Council of Advisors on Ocean Policy, composed of representatives from the State and local government, industry, nongovernmental organizations, and others who can provide non-Federal perspectives on ocean policy. All over the Nation, including our hearings up in Boston, counties, States and regions are calling for a greater role in the up-front planning of all of these issues. They do not want to have unfunded mandates. They do not want to be told how to clean up every piece of debris that is out there and every pollution item. They want to be given some national goals and policies within which their own programs can fit, and this would provide a mechanism at the highest level of Government, similar to the President's Council of Advisors on Science and Technology.

The Congress is the one that set up the Office of Science and Technology, not the White House, and it was a good idea. And if the President wants to listen to the science adviser he certainly can. If he does not, then it does not get the time of day. So we rec-

ognize that but we think it is very important for the non-Federal component of the leadership team in Washington to be set up as a kind of a co-leader, and we have asked also that the Assistant to the President co-chair this Council of Advisors, along with a non-Federal co-chair, much as we do in the President's Council of Advisors on Science and Technology.

REGIONAL OCEAN COUNCILS

The Commission recommends that there be a network of broadly inclusive, voluntarily established regional ocean councils to help coordinate programs at the regional ecosystem level. The Oceans Act of 2000 directed us not to impose specific recommendations on a single State but to recommend improved Federal cooperation with the States because it's the people out there that have the real job of doing the work, in the coastal areas in particular.

So we said these councils should be voluntary at the outset. We should incentivize pilot programs for those that want to participate. If the regions do not want to come together and participate, that is their business, but for those that do, we want to incentivize those programs, learn from them, and perhaps sometime downstream make it more formal, with legislative support. We do not ask for that right now because we think it is premature to try to force anything in the system. Let us try it, see if it could work, see if we can set up this President's Council of Advisors, see if they can work with the National Ocean Council and do the job.

OFFSHORE MANAGEMENT REGIME

We say there needs to be a coordinated offshore management regime that encompasses traditional and emerging uses and is flexible enough to incorporate uses not yet foreseen. Off Cape Cod we have proposals for wind farms, and in other areas we have people moving toward deep ocean aquaculture, we may have bioprospecting, all of these issues, and they need some kind of national regime within which they can fit. We do not have such a structure today.

Right now it is the Rivers and Harbors Act, Section 10 I believe it is, that the Corps of Engineers is using to determine whether it is appropriate to put the wind farms off of Cape Cod. We believe that this, along with the other issues, needs a comprehensive and coordinated offshore regime established by the Congress in consultation with the NOC.

STRENGTHENING THE FEDERAL AGENCY STRUCTURE

We also need a strengthened and streamlined Federal agency structure achieved through a phased approach, as outlined in our report. During this morning's hearing we had quite a discussion about that. We are saying, let's not try to do everything now. Let us do phase one, which is to get our act together at the National Ocean Council level. Let us get Congress to authorize that. Let us enact a new law for NOAA, an organic act that puts them into the ecosystem-based management mode, and let us do that right now.

Then we can begin to bring under the strengthened NOAA concept, a variety of entities out of Interior, EPA, Energy, Navy, Corps

of Engineers, that could begin to play a part in this ecosystem-based management approach. NOAA is not there today, so we need to let it grow a little bit.

Then 5 to 7 years from now, if the Congress feels it is time to have a department of natural resources or some other concept, you are ready to do it. You have already gone through all the growing pains, the lessons learned, and we are ready to do it in a sensible way without putting so much energy on reorganization that we end up ignoring the other 195 recommendations that have to be carried out.

We have a lot of issues in here that have to be addressed today. We cannot wait for some organizational monster to be created and focus all of our energies on that. So it is a phased approach we are talking about.

An organic act for NOAA we think is essential and that is where the Congress can get in and fine tune the agency structure so that it matches the ecosystem-based approach we have recommended.

OCEAN POLICY TRUST FUND

Let me now turn to the Ocean Policy Trust Fund. I asked the committee if it would be appropriate for me to bring the Executive Director along because he is the pro in this area for the Commission and he knows how those revenue streams work. He knows what is allocated out of the $5 billion a year revenue that comes in from offshore oil and gas. He knows what happens with the unallocated portion. We think there is a legitimate claim that the unallocated funds should be used to help pay for ocean and coastal activities. We think it is a method to do it. We understand how you score it up here. It is still a budget issue. It is still subject to appropriations, but we think the Highway Trust Fund has worked; we think the Ocean Policy Trust Fund can be similarly important.

So those are the things we are asking. We can go into greater detail and I have my commissioners up here who are experts in all of these areas and ready to answer questions. That is sufficient for an oral presentation, without going into the economic benefits of this and the status of the oceans. Everybody agrees. The Pew Commission and we all agree that the oceans are in trouble. They need addressing and the management regime we have today just is not adequate to the task.

So at any rate I would like to wrap up by asking Tom Kitsos, our Executive Director, to summarize in more detail the creation of an Ocean Policy Trust Fund, which is obviously very important to this committee.

Mr. KITSOS. Thank you. Mr. Chairman, I will try to do this in about a minute or two, if possible.

In recent years, revenues from offshore oil and gas development coming into the Federal Government total, on average, about $5 billion. Of that $5 billion, some money is allocated to the Land and Water Conservation Fund. Not all of it is appropriated but it goes into that fund. Some money is allocated to the National Historic Preservation Fund. Not all is appropriated but it goes into the fund. And some money goes directly to coastal States under what is called the section 8(g) part of the Outer Continental Shelf Lands Act. I will not go into detail about that but essentially 27 percent

of the revenues that come from the area from 3 to 6 miles offshore, an area from which, arguably Federal lessees are draining State resources, go to the States.

So with those three allocated or dedicated funds—Land and Water Conservation, Historic Preservation, and 8(g)—roughly speaking about $1 billion is allocated, give or take a few hundred million dollars. So if you take the $5 billion that comes in, you hold harmless the Land and Water Conservation, Historic Preservation, and 8(g) funds, that leaves $4 billion which, under section 9 of the OCS Lands Act, goes into miscellaneous receipts of the Treasury of the United States.

What the Commission is recommending is that those unallocated monies, rather than going into miscellaneous receipts, be deposited into a special newly created fund called the Ocean Policy Trust Fund in the Treasury of the United States. It is not mandatory spending. We understand that it is a Treasury receipt and currently miscellaneous receipts count toward the deficit. We understand also that the appropriation is still scored as discretionary budget authority and outlays; it is general fund revenue. What we are suggesting is that rather than acting as miscellaneous receipts, there should be a dedicated fund, money coming from offshore activities, from oil and gas, to be dedicated for use for ocean and coastal purposes.

We also suggest that in the future when other revenues come into the Treasury from marine aquaculture or wind farms if they become profitable or marine biotechnology projects or other projects that occur in Federal water for which resource rents are charged by the lead Federal agency, that those monies also go into the fund.

And of the monies that go into the Ocean Policy Trust Fund, they would be basically given back to Federal agencies and to States. For the Federal agencies we suggest that the money go to the Federal agencies that need this money to carry out any additional responsibilities they will incur as a result of implementation of recommendations made by the Ocean Policy Commission and that such allocation among the Federal agencies would be determined by the National Ocean Council, which the Admiral just referred to as a newly created institution within the White House.

Of the money that would be allocated to the States, what we are suggesting in the Commission report is, after about a 3-year ramp-up, roughly $1 billion would be made available to all coastal States, a disproportionate amount going to States for which there is oil and gas development off their shores. But of the amount that would remain, we suggest that the money be allocated among all coastal States based on a formula to be determined by Congress for two purposes for the States.

One, to carry out any additional responsibilities that they may incur as a result of recommendations of this report, thus fulfilling the Commission's goal not to impose any unfunded mandates on States if these recommendations are implemented. Two, because States through their land and water use and zoning authorities within their sovereign borders and submerged lands, have responsibilities for the protection and conservation and sustainability of ocean and coastal resources and these responsibilities have historically not been well funded. It is the suggestion of the Commission

that using this fund, some of those programs can, in fact, be enhanced.

I am obviously leaving out many details, Mr. Chairman, but in a sense, that is the trust fund proposal from the Commission.

Admiral WATKINS. That completes our oral presentation, Mr. Chairman. We open the floor for any questions you may have.

[The statement follows:]

PREPARED STATEMENT OF ADMIRAL JAMES D. WATKINS

INTRODUCTION

Mr. Chairman and members of the Committee, I am pleased to appear before you to discuss the Preliminary Report of the U.S. Commission on Ocean Policy, which was released to the public on Tuesday, April 20. We believe this report offers a blueprint for a coordinated, comprehensive national ocean policy for the 21st century. It includes nearly 200 action-oriented recommendations that present workable solutions for a broad range of ocean- and coastal-related issues.

As you know, the last comprehensive review of U.S. ocean policy took place more than 35 years ago when the Commission on Marine Science, Engineering and Resources—known as the Stratton Commission—issued its report, *Our Nation and the Sea*. Since then, considerable progress has been made, but many challenges remain and new issues have emerged. The value of the oceans to our nation has only grown in 35 years, and the time to act is now.

The simple fact is that the oceans affect and sustain all life on Earth. They drive and moderate weather and climate, provide us with food, oxygen, transportation corridors, recreational opportunities, energy resources and other natural products, and serve as a national security buffer. In our travels around the country, we heard and saw first-hand how communities care about the ocean and coasts, and how they worry about their future.

THE VALUE OF THE OCEANS AND COASTS

America's oceans and coasts provide ecological and aesthetic benefits with tremendous value to our national economy. In 2000, the ocean economy contributed more than $117 billion to American prosperity and supported well over two million jobs. More than $1 trillion, or one-tenth of the nation's annual GDP, is generated within the relatively narrow strip of land immediately adjacent to the coast. Considering the economies of all coastal watershed counties, that contribution swells to over $4.5 trillion, fully half of the nation's GDP. The contribution to employment is equally impressive, with 16 million jobs in the nearshore zone and 60 million in coastal watershed counties.

The country also remains highly dependent on marine transportation. More than thirteen million jobs are connected to the trade transported through the nation's network of ports and inland waterways. Annually, the nation's ports handle more than $700 billion in goods. The cruise industry and its passengers account for another $11 billion in spending.

Offshore oil and gas operations have expanded into deeper waters with new and improved technologies. The offshore oil and gas industry's annual production is valued at $25 to $40 billion, and its yearly bonus bid and royalty payments contribute approximately $5 billion to the U.S. Treasury.

The commercial fishing industry's total annual value exceeds $28 billion, with the recreational saltwater fishing industry valued at around $20 billion, and the annual U.S. retail trade in ornamental fish worth another $3 billion. Nationwide, retail expenditures on recreational boating exceeded $30 billion in 2002.

In the last three decades, more than 37 million people and 19 million homes have been added to coastal areas. Every year, hundreds of millions of Americans and international visitors flock to the coasts to enjoy the oceans, spending billions of dollars and directly supporting more than a million and a half jobs. In fact, tourism and recreation is one of the fastest-growing business sectors—enriching economies and supporting jobs in communities virtually everywhere along the coasts of the continental United States, southeast Alaska, Hawaii, and our island territories and commonwealths.

These concrete, quantifiable contributions to the national economy are just one measure of the oceans' value. We also love the oceans for their beauty and majesty, and for their intrinsic power to relax, rejuvenate, and inspire. Unfortunately, we are starting to love our oceans to death.

TROUBLE IN PARADISE

Development comes with costs, and we are only now discovering the full extent of those costs. Pollution, depletion of fish and other living marine resources, habitat destruction and degradation, and the introduction of invasive non-native species are just some of the ways people harm the oceans, with serious consequences for the entire planet.

In 2001, 23 percent of the nation's estuarine areas were not suitable for swimming, fishing, or supporting marine species. In 2002, about 12,000 beach closings and swimming advisories were issued across the nation, most due to the presence of bacteria associated with fecal contamination. Marine toxins afflict more than 90,000 people annually across the globe and are responsible for an estimated 62 percent of all seafood-related illnesses. Such events are on the rise, costing millions of dollars a year in decreased tourism revenues and increased health care costs.

Experts estimate that 25 to 30 percent of the world's major fish stocks are overexploited, and many U.S. fisheries are experiencing similar difficulties. Since the Pilgrims first arrived at Plymouth Rock, over half of our fresh and saltwater wetlands—more than 110 million acres—have been lost.

Our failure to properly manage the human activities that affect oceans and coasts is compromising their ecological integrity and diminishing our ability to fully realize their potential. Congress recognized this situation when it passed the Oceans Act of 2000 calling for a Commission on Ocean Policy to establish findings and develop recommendations for a coordinated and comprehensive national ocean policy. Pursuant to that Act, the President appointed 16 Commission members, including individuals nominated by the leadership in the United States Senate and the House of Representatives. These individuals were drawn from diverse backgrounds with knowledge in ocean and coastal activities.

Because of the vast scope of topics the Commission was required to address, it sought input from individuals across the country. The Commission members traveled around the United States obtaining valuable information from diverse marine-related interests. They heard testimony on ocean and coastal issues during nine regional meetings and experienced regional concerns first-hand during seventeen site visits. The regional meetings also highlighted relevant success stories and regional models with potential national applicability.

Four additional public meetings were held in Washington, D.C., after completion of the regional meetings, to publicly present and discuss many of the policy options under consideration for the Commission's recommendations. In all, the Commission heard from some 445 witnesses, including over 275 invited presentations and an additional 170 comments from the public, resulting in nearly 1,900 pages of testimony (included as Appendices to the report).

The message we heard was clear: the oceans and coasts are in trouble and major changes are urgently needed. While new scientific understanding shows that natural systems are complex and interconnected, our decisionmaking and management approaches have not been updated to reflect that complexity and interconnectedness. Responsibilities remain dispersed among a confusing array of agencies at the Federal, State, and local levels. Better approaches and tools are also needed to gather data to understand the complex marine environment. Perhaps most important, people must understand the role the oceans have on their lives and livelihoods and the impacts they themselves have on the oceans.

As the result of significant thought and deliberation and the consideration of a wide range of potential solutions, the Commission prepared its preliminary report containing bold and broad-reaching recommendations for reform—reform that needs to start now, while it is still possible to reverse distressing declines, seize exciting opportunities, and sustain the oceans and their valuable assets for future generations.

VISION AND STRATEGY FOR THE 21ST CENTURY

Any strategy for change must begin with a clear picture of the desired endpoint. In the desirable future we wish to create, the oceans and coasts would be clean, safe, and sustainably managed. They would contribute significantly to the economy, supporting multiple beneficial uses such as food production, development of energy and mineral resources, recreation, transportation of goods and people, and the discovery of novel medicines and other products, while preserving a high level of biodiversity and a full range of natural habitats. The coasts would be attractive places to live, work and play, with clean water and beaches, easy public access, sustainable economies, safe bustling harbors and ports, adequate roads and services, and special protection for sensitive habitats. Beach closings, toxic algal blooms, proliferation of invasive species, and vanishing native species would be rare. Better land use plan-

ning and improved predictions of severe weather and other natural hazards would save lives and money.

The management of our oceans and coasts would also look different: it would follow ecosystem boundaries, considering interactions among all elements of the system, rather than addressing isolated areas or problems. In the face of scientific uncertainty, managers would balance competing considerations and proceed with caution. Ocean governance would be effective, participatory, and well coordinated among government agencies, the private sector, and the public.

Managers and politicians would recognize the critical importance of good data and science, providing strong support for physical, biological, social, and economic research. The nation would invest in the tools and technologies needed to conduct this research: ample, well-equipped surface and underwater research vessels; reliable, sustained satellites; state-of-the-art computing facilities; and innovative sensors that withstand harsh ocean conditions. A widespread network of observing and monitoring stations would provide data for research, planning, marine operations, timely forecasts, and periodic assessments. Scientific findings and observations would be translated into practical information, maps, and products used by decisionmakers and the public.

Better education would be a cornerstone of ocean policy, with the United States once again joining the top ranks in math, science, and technology achievement. An ample, well-trained, and motivated workforce would be available to study the oceans, set wise policies, apply technological advances, engineer new solutions, and teach the public about the value and beauty of the oceans and coasts throughout their lives. As a result of this lifelong education, people would understand the links among the land, sea, air, and human activities and would be better stewards of the nation's resources.

Finally, the United States would be a leader and full partner globally, sharing its science, engineering, technology, and policy expertise, particularly with developing countries, to facilitate the achievement of sustainable ocean management on a global level.

The Commission believes this vision is practical and attainable. To achieve it, national ocean policy should be guided by a set of overarching principles including the following:

Sustainability.—Ocean policy should be designed to meet the needs of the present generation without compromising the ability of future generations to meet their needs.

Stewardship.—The principle of stewardship applies both to the government and to every citizen. The U.S. government holds ocean and coastal resources in the public trust—a special responsibility that necessitates balancing different uses of those resources for the continued benefit of all Americans. Just as important, every member of the public should recognize the value of the oceans and coasts, supporting appropriate policies and acting responsibly while minimizing negative environmental impacts.

Ocean-Land-Atmosphere Connections.—Ocean policies should be based on the recognition that the oceans, land, and atmosphere are inextricably intertwined and that actions that affect one Earth system component are likely to affect another.

Ecosystem-based Management.—U.S. ocean and coastal resources should be managed to reflect the relationships among all ecosystem components, including humans and nonhuman species and the environments in which they live. Applying this principle will require defining relevant geographic management areas based on ecosystem, rather than political, boundaries.

Multiple Use Management.—The many potentially beneficial uses of ocean and coastal resources should be acknowledged and managed in a way that balances competing uses while preserving and protecting the overall integrity of the ocean and coastal environments.

Preservation of Marine Biodiversity.—Downward trends in marine biodiversity should be reversed where they exist, with a desired end of maintaining or recovering natural levels of biological diversity and ecosystem services.

Best Available Science and Information.—Ocean policy decisions should be based on the best available understanding of the natural, social, and economic processes that affect ocean and coastal environments. Decisionmakers should be able to obtain and understand quality science and information in a way that facilitates successful management of ocean and coastal resources.

Adaptive Management.—Ocean management programs should be designed to meet clear goals and provide new information to continually improve the scientific basis for future management. Periodic reevaluation of the goals and effectiveness of management measures, and incorporation of new information in implementing future management, are essential.

Understandable Laws and Clear Decisions.—Laws governing uses of ocean and coastal resources should be clear, coordinated, and accessible to the nation's citizens to facilitate compliance. Policy decisions and the reasoning behind them should also be clear and available to all interested parties.

Participatory Governance.—Governance of ocean uses should ensure widespread participation by all citizens on issues that affect them.

Timeliness.—Ocean governance systems should operate with as much efficiency and predictability as possible.

Accountability.—Decisionmakers and members of the public should be accountable for the actions they take that affect ocean and coastal resources.

International Responsibility.—The United States should act cooperatively with other nations in developing and implementing international ocean policy, reflecting the deep connections between U.S. interests and the global ocean.

Ecosystem-based Management

Ecosystem-based management emerged as an overarching theme of the Commission's work. To move toward more ecosystem-based approaches, managers must consider the relationships among all ecosystem components, including human and nonhuman species and the environments in which they live. Management areas should be defined based on ecosystem, rather than political, boundaries. A balanced precautionary approach should be adopted that weighs the level of scientific uncertainty and the potential risk of damage before proceeding.

In moving toward an ecosystem-based approach, the U.S. Commission on Ocean Policy considers the following actions absolutely critical. First, a new national ocean policy framework must be established to improve Federal leadership and coordination and enhance opportunities for State, territorial, tribal, and local entities to improve responses at the regional level. Second, decisions about ocean and coastal resources need to be based on the most current, credible, unbiased scientific data. And third, improved education about the oceans is needed to give the general public a sense of stewardship and prepare a new generation of leaders to address ocean issues.

IMPROVING GOVERNANCE

Many different entities at the Federal, regional, State, territorial, tribal and local levels participate in the management of the nation's oceans and coasts. At the Federal level, eleven of the fifteen existing cabinet-level departments and four independent agencies play important roles in the development of ocean and coastal policy. All of these Federal agencies also interact in various ways with State, territorial, tribal, and local entities.

A lack of communication and coordination among the various agency programs at the national level, and among Federal, State and local stakeholders at the regional level, continues to inhibit effective action. A new National Ocean Policy Framework is needed to provide high-level attention and coordinated implementation of an integrated national ocean policy.

National Coordination and Leadership

A first step in enhancing management, and a central part of the new National Ocean Policy Framework, is improved coordination among the many Federal programs. A number of attempts have been made to coordinate on particular topics, such as coral reefs or marine transportation, or within a broad category, such as ocean science and technology. Within the Executive Office of the President, three entities have specific responsibilities relevant to oceans: the Office of Science and Technology Policy that addresses government-wide science and technology issues and includes an ocean subcommittee; the Council on Environmental Quality (CEQ) that oversees broad Federal environmental efforts and implementation of the National Environmental Policy Act; and the National Security Council's Policy Coordinating Committee that addresses international issues and also includes a subcommittee on international ocean issues.

While all these coordinating bodies are helpful in their designated areas of interest, they do not constitute a high-level interagency mechanism able to deal with all of the interconnected ocean and coastal challenges facing the nation, including not only science and technology, the environment, and international matters, but the many other economic, social, and technical issues that affect the ocean.

The value of the ocean to American society also cries out for greater visibility and leaderships. Only the Executive Office of the President can transcend traditional conflicts among departments and agencies, make recommendations for broad Federal agency reorganization, and provide guidance on funding priorities, making it the appropriate venue for coordinating an integrated national ocean policy.

National Ocean Council

Congress should establish a National Ocean Council within the Executive Office of the President to provide high-level level attention to ocean and coastal issues, develop and guide the implementation of appropriate national policies, and coordinate the many Federal departments and agencies with ocean and coastal responsibilities. The National Ocean Council, or NOC, should be composed of cabinet secretaries of departments and directors of independent agencies with relevant ocean- and coastal-related responsibilities and should carry out a variety of functions including the following: developing broad principles and national goals for ocean and coastal governance; making recommendations to the President on national ocean policy; coordinating and integrating activities of ocean-related Federal agencies; identifying statutory and regulatory redundancies or omissions and developing strategies to resolve conflicts, fill gaps, and address new and emerging ocean issues; and developing and supporting partnerships between government agencies and nongovernmental organizations, the private sector, academia, and the public.

Presidential Council of Advisors on Ocean Policy

A Presidential Council of Advisors on Ocean Policy, co-chaired by the chair of the National Ocean Council and a non-Federal member, should advise the President on ocean and coastal policy matters and serve as a formal structure for input from non-Federal individuals and organizations. It should be composed of a representative selection of individuals appointed by the President, including governors of coastal states, other appropriate State, territorial, tribal and local government representatives, and individuals from the private sector, research and education communities, nongovernmental organizations, watershed organizations and other non-Federal bodies with ocean interests. The members should be knowledgeable about and experienced in ocean and coastal issues.

Need for Presidential Action—the Assistant to the President

Although Congress should establish the National Ocean Council and the Presidential Council of Advisors on Ocean Policy in law to ensure their long-term future, the Commission is cognizant of the complex and often lengthy nature of the legislative process. While awaiting congressional action, the President should immediately establish these entities through Executive Order, and should appoint an Assistant to the President to chair the Council. As chair of the NOC and co-chair of the Presidential Council of Advisors on Ocean Policy, the Assistant to the President should lead the coordination of Federal agency actions related to oceans and coasts, make recommendations for Federal agency reorganization as needed to improve ocean and coastal management, resolve interagency policy disputes, and promote regional approaches. The Assistant to the President should also advise OMB and the agencies on appropriate funding levels for important ocean- and coastal-related activities, and prepare a biennial report as mandated by section 5 of the Oceans Act of 2000.

Office of Ocean Policy

Because the National Ocean Council will be responsible for planning and coordination rather than operational duties, the support of a small staff and committees will be required to carry out its functions. An Office of Ocean Policy should support the Assistant to the President, the National Ocean Council, and the Presidential Council of Advisors on Ocean Policy. The Office of Ocean Policy should be composed of a small staff that reports to the Assistant to the President, managed by an executive director responsible for day-to-day activities. Strong links should be maintained among the National Ocean Council, its committees and staff, other parts of the Executive Office of the President, and ocean-related advisory councils and commissions.

Committee on Ocean Science, Education, Technology, and Operations

A committee under the National Ocean Council will be needed to assume the functions of the current National Ocean Research Leadership Council (NORLC), a congressionally-established government coordination and leadership organization for oceanographic research programs on the national level. By placing the NORLC under the NOC and broadening its responsibilities to include operational programs and educational activities in addition to research, it will become more visible and more effective. In recognition of its broader mandate, the NORLC should be redesignated as the Committee on Ocean Science, Education, Technology, and Operations (COSETO). Strong connections between the Office of Science and Technology Policy and the NOC (through COSETO) will be essential. To eliminate overlapping functions, the National Science and Technology Council's Joint Subcommittee on Oceans, should be subsumed into COSETO.

Committee on Ocean Resource Management

The National Ocean Council will need a second committee, to coordinate Federal resource management policy, including the many existing, single-issue coordination efforts such as the Coral Reef Task Force, the Interagency Committee on the Marine Transportation System, the National Dredging Team, Coastal America, and many others. The NOC Committee on Ocean Resource Management (CORM) would perform high-level, cross-cutting oversight of these issue-specific efforts to ensure consideration of cumulative impacts, minimize conflicting mandates, and implement an ecosystem-based management approach. Because of the Council on Environmental Quality's role in environmental issues, this office should also maintain strong connections with the National Ocean Council and its CORM.

A Regional Approach

In addition to improved coordination at the national level, an important component of the new National Ocean Policy Framework is the promotion of regional approaches that allow decisionmakers to address issues across jurisdictional lines. The nation's ocean and coastal resources are affected by human activities that span cities, counties, States, and sometimes nations. Federal, State, territorial, tribal, and local governments need the ability to respond to ocean and coastal issues in a coordinated fashion within regions defined by the boundaries of ecosystems rather than somewhat arbitrary government jurisdictions. The voluntary establishment of regional ocean councils, improved coordination of Federal agency efforts at the regional level, and dissemination of regionally significant research and information would enhance regional coordination and improve responses to regional issues.

Creating Regional Ocean Councils

There are many examples where concern for the health of a particular ecosystem (such as the Chesapeake Bay, Pacific Northwest, Gulf of Mexico, or Mississippi River Basin) has motivated a wide range of participants to create new structures for addressing regional concerns. There is a growing awareness that existing regional approaches can be strengthened and similar approaches can benefit the health and productivity of all the nation's ocean and coastal regions.

Regional ocean councils can serve as mechanisms for a wide range of participants to join forces to address issues of regional concern, realize regional opportunities, identify regional goals, and promote a sense of stewardship for a specific area among all levels of government, private interests, and the public. It will be up to the participants—including representatives from all levels of government, the private sector, nongovernmental organizations, and academia—to determine how the council will operate in each region. Possible council functions might include: designating ad hoc subcommittees to examine specific issues of regional concern; mediating and resolving disputes among different interests in the region; monitoring and evaluating the state of the region and the effectiveness of management efforts; building public awareness about regional ocean and coastal issues; facilitating government approvals or permitting processes that involve several Federal, State, and local government agencies within the region; and helping to link activities located in upstream, coastal, and offshore areas within an ecosystem-based management context.

Regional ocean councils should be created by interested parties at the State and local level, rather than mandated by the Federal Government. However, to stimulate the process, the National Ocean Council should develop flexible guidelines for the voluntary creation of regional ocean councils. Initial efforts should be encouraged in regions where readiness and support for a regional approach is already strong. The first councils can then serve as pilot projects, allowing those involved to learn what works in the region, building support to implement a regional ocean council, and paving the way for councils in other regions. Once established, regional ocean councils will most likely evolve, as participants identify the structure and functions that best suit their needs. Whether a council has decisionmaking authority will be up to the regional participants. National involvement may be necessary to implement more formal decisionmaking mechanisms such as legislation, interagency agreements, and interstate compacts.

Regional ocean councils should encompass an area from the inland extent of coastal watersheds to the offshore boundary of the nation's EEZ. The boundaries of the Regional Fishery Management Councils (RFMCs) may be considered as a starting point, although these regions may not always be suitable. For example, more than one regional ocean council will probably be necessary within California where there is only one RFMC. A regional ocean council for the Great Lakes region is also desirable.

Improving Regional Coordination of Federal Agencies

While the process of planning, establishing, and testing regional ocean councils is underway, Federal agencies should be directed to immediately improve their own regional coordination and provide stronger institutional, technical, and financial support for regional issues. Currently, the actions of Federal agencies often overlap, conflict, or are inconsistent with one another at the regional and State levels. Although several Federal agencies already divide their operations into regions, the boundaries of these regions differ from one agency to the next, the functions of regional offices vary widely, and it is common for the regional office of one agency to operate in isolation from the regional offices of other agencies. Improved regional coordination should be a first step, followed in time by Federal reorganization around common regional boundaries.

Enhancing Regional Research and Information

Decisionmakers at all levels need the best available science, information, tools, and technology on which to base ocean and coastal management decisions. However, research and data collection targeted at regional concerns is severely limited. Furthermore, the data that do exist are rarely translated into products that are useful to managers. Regional ocean information programs should be established to set priorities for research, data collection, information products, and outreach activities in support of improved regional management. Where and when they are established, regional ocean councils will be the logical bodies to administer these programs.

Improved Governance of Offshore Waters

Converging economic, technological, legal, and demographic factors make Federal waters an increasingly attractive place for enterprises seeking to tap the ocean's resources. The challenge for policymakers will be to realize the ocean's potential while minimizing conflicts among users, safeguarding human and marine health, and fulfilling the Federal Government's obligation to manage public resources for the maximum long-term benefit of the entire nation. While institutional frameworks exist for managing some ocean uses, increasingly unacceptable gaps remain.

The array of agencies involved, and their frequent lack of coordination, can create roadblocks to public participation, discourage private investment, cause harmful delays, and generate unnecessary costs. This is particularly true for new ocean uses that are subject to scattered or ill defined Federal agency authorities and an uncertain decisionmaking process. Without an understandable, streamlined, and broadly accepted method for reviewing proposed activities, ad hoc management approaches will continue, perpetuating uncertainty and raising questions about the comprehensiveness and legitimacy of decisions.

To start, each existing or foreseeable activity in Federal waters should be overseen by one lead Federal agency, designated by Congress to coordinate among all the agencies with applicable authorities while ensuring full consideration of the public interest. Pending such designations, the NOC should assign agencies to coordinate research, assessment, and monitoring of new offshore activities.

But better management of individual activities is only a first step. To move toward an ecosystem-based management approach, the Federal Government should develop a broad understanding of offshore areas and their resources, prioritize all potential uses, and ensure that activities within a given area are compatible. As the pressure for offshore uses grows, and before serious conflicts arise, coordination should be improved among the management programs for different offshore activities. The National Ocean Council should review each single-purpose program that regulates some offshore activity with the goal of determining how all such programs may be better coordinated.

Ultimately, the nation needs a coordinated offshore management regime that encompasses traditional and emerging uses, and is flexible enough to incorporate uses not yet foreseen. The new regime will need to make decisions and resolve disputes through an open process accepted by all parties. Congress, working with the NOC and regional ocean councils, should establish such an offshore management regime and establish principles for offshore use, including the need to: integrate single-purpose programs within the broader offshore regime; create a planning process for new and emerging activities; and ensure a reasonable return to the public in exchange for allowing private interests to profit from public resources.

Establishing a coordinated offshore management regime will take time, and it will not be easy. No regime for governing ocean activities will eliminate all conflicts, given the complexity of the problems and the diverse perspectives of competing interests. However, the National Ocean Council, Presidential Council of Advisors on Ocean Policy, regional ocean councils, and other components of the National Ocean

Policy Framework provide a promising basis for more coordinated, participatory management of ocean activities.

Marine Protected Areas

In contemplating the coordinated, ecosystem-based management of both nearshore and offshore areas, marine protected areas can be a valuable tool. Marine protected areas can be created for many different reasons, including conserving living marine resources and habitat, protecting endangered or threatened species, maintaining biological diversity, and preserving historically or culturally important submerged archaeological resources. These areas have also been recognized for their scientific, recreational, and educational values.

The creation of new MPAs can be a controversial process: supported by those who see their benefits, while vigorously opposed by others who dislike the limitations MPAs impose on ocean uses. Thus, it is important to engage local and regional stakeholders in the design and implementation of marine protected areas to build support and ensure compliance with any restrictions. Because marine protected areas also have national implications, such as possible impacts on freedom of navigation, Federal involvement and oversight will still be needed.

With its multiple use, ecosystem-based perspective, the National Ocean Council should oversee the development of a flexible process—which is adaptive and based on best available science—to design and implement marine protected areas. Regional ocean councils, or other appropriate entities, can provide a forum for applying the process developed by the NOC, with broad stakeholder participation.

Strengthening and Streamlining the Federal Agency Structure

Although improved coordination is a vital aspect of the new National Ocean Policy Framework, changes to the Federal agency structure itself will also be needed. The proliferation of Federal agencies with some element of responsibility for ocean and coastal activities immediately suggests that some consolidation is possible. Combining similar ocean and coastal functions and programs could improve government performance, reduce unnecessary overlaps, facilitate local, State, and regional interactions with the Federal Government, and begin to move the nation toward a more ecosystem-based management approach.

However, the complex Legislative and Executive Branch process for making such changes compels a cautious, methodical, multi-phased approach for improving the Federal structure.

Strengthening NOAA—Phase I

NOAA's mission is to understand and predict changes in the Earth's environment and to conserve and manage ocean and coastal resources to meet the nation's economic, social, and environmental needs. Since its creation, NOAA has made significant strides in many areas, despite programmatic and functional overlaps and frequent disagreements and disconnects among its five line offices. Although the organization has evolved over time, including the recent creation of a sixth line office to improve integration on specific issues, these changes take time and results can be hard to quantify.

There is widespread agreement that NOAA needs to manage its current activities more effectively. Moreover, if the recommendations in the Commission's preliminary report are implemented, NOAA will be required to handle a number of new responsibilities. A stronger, more effective, science-based and service-oriented ocean agency—one that contributes to better management of oceans and coasts through an ecosystem-based approach—is needed.

NOAA's three primary functions can be summarized as follows:

(1) Assessment, prediction, and operations for ocean, coastal, and atmospheric environments, including mapping and charting, satellite-based and in situ data collection, implementation of the Integrated Ocean Observing System, data information systems, and weather services and products.

(2) Marine resource and area management, including fisheries, ocean and coastal areas, vulnerable species and habitats, and protection from pollution and invasive species.

(3) Scientific research and education, including a focus on applied research, the availability of scientifically valid data, and promotion of educational activities.

One of the critical objectives for a strengthened NOAA is improved performance within these categories and smoother interactions among them. For example, resource management decisions should be based on the best available science, research itself should be planned to support the agency's management missions, and research in different areas—sea, land, and air—should be connected and coordinated. Changes of this nature will likely require adjustments to the internal oper-

ation of the agency, including possible additional changes to the current line office structure.

These changes can be promoted by codifying the establishment and functions of the National Oceanic and Atmospheric Administration through passage of an organic act for the agency. The act should ensure that NOAA's structure is consistent with the principles of ecosystem-based management and with its primary functions: assessment, prediction, and operations; management; and research and education. NOAA will require budget support commensurate with its important, varied, and growing responsibilities.

Reviewing NOAA's Budget

NOAA's placement within the Department of Commerce has an unusual history and continues to be questioned by many observers. If nothing else, this affiliation has distinct budgetary implications. As part of DOC, NOAA's budget is reviewed within the Office of Management and Budget's General Government Programs, along with other DOC programs with fundamentally different characteristics and missions. NOAA's OMB review also fails to consider its ocean and atmospheric programs in context with other Federal resource management and science programs. To support the move toward a more ecosystem-based management approach, NOAA's budget should be reviewed within OMB's Natural Resources Programs, along with the budgets of more similar departments and agencies.

Consolidating Ocean and Coastal Programs—Phase II

As I have said, many agencies across the Federal Government—in addition to NOAA—administer ocean- and coastal-related programs. Although I have focused on NOAA as the primary ocean agency, the other agencies should also be strengthened in similar ways.

However, even solid performance within each agency will not eliminate the many similar or overlapping activities. In some cases, programmatic overlap can provide useful checks and balances as agencies bring different perspectives and experiences to the table. In other cases, the number of separate agencies addressing a similar issue is not helpful. Such fragmentation diffuses responsibility, introduces unnecessary overlap, raises administrative costs, inhibits communication, and interferes with the development of a comprehensive management regime that addresses issues within an ecosystem-based context.

The Commission's preliminary report presents specific recommendations on program consolidation in areas such as nonpoint source pollution, area-based ocean and coastal resource management, vessel pollution, invasive species, marine mammals, aquaculture, and satellite-based Earth observing. Using these recommendations as a starting point, the Assistant to the President, with advice from the National Ocean Council and the Presidential Council of Advisors on Ocean Policy, should review Federal ocean, coastal and atmospheric programs, and recommend further opportunities for consolidation.

Programs not suitable for consolidation—such as security-related programs that cannot be transferred without harm to the overall enterprise—should continue to be coordinated through the National Ocean Council and the regional ocean councils. However, in most cases, judicious consolidation of ocean- and coastal-related functions will improve policy integration and program effectiveness.

Presidential Reorganization Authority

The recommended program consolidation will not be easy within the current legislative process. The creation and reorganization of agencies is often contentious, lengthy, and uncertain, involving multiple committees in both houses of Congress. Recognizing this shortcoming, Congress has several times in the past chosen to give the President limited reorganization authority. Renewing this authority by allowing the President to propose agency reorganization, with an expedited and limited congressional review and approval process, would provide an excellent mechanism to achieve reorganization of Federal ocean- and coastal-related agencies in a timely fashion.

Managing all Natural Resources in an Ecosystem-based Management Context—Phase III

Strengthening the performance of ocean, coastal, and atmospheric programs through coordination and consolidation are important steps in moving toward an ecosystem-based management approach. By immediately establishing the National Ocean Council and strengthening NOAA, followed by the consolidation of suitable ocean and coastal programs and functions, the nation will be poised to take a further step in strengthening the Federal Government structure.

Based on a growing understanding of ecosystems, including recognition of the inextricable links among the sea, land, air, and all living things, a more fundamental reorganization of Federal resource agencies will eventually be needed. Consolidation of all natural resource functions, including those involving oceans and coasts, would enable the Federal Government to move toward true ecosystem-based management. This could be implemented through the establishment of a Department of Natural Resources or some other structural unification that brings together all of the nation's natural resource programs.

SCIENCE-BASED DECISIONS: ADVANCING OUR UNDERSTANDING OF THE OCEANS

Ecosystem-based management provides many potential benefits, but also imposes new responsibilities on managers. The need to collect good information and to improve understanding is perhaps foremost among these new responsibilities. Despite considerable progress over the last century, the oceans remain one of the least explored and most poorly understood environments on the planet.

Greater knowledge can enable policymakers and managers to make wise, science-based decisions at the national, regional, State, and local levels. However, existing research and monitoring programs, which tend to be agency-specific and single issue oriented, will need to be reorganized to support ecosystem-based management. The current mismatch between the size and complexity of marine ecosystems and the fragmented research and monitoring programs for coastal and ocean ecosystems must be resolved.

The nation also lacks effective mechanisms for incorporating scientific information into decisionmaking in a timely manner. As knowledge improves, it must be translated into useful terms and actively incorporated into policy through an adaptive process. To make the translation effective, local, State, regional, and national managers need avenues to communicate their information needs and priorities to the research community. In addition to these practical needs, ocean science and technology will continue to be an integral part of the overall U.S. basic research enterprise and future discoveries will undoubtedly contribute greatly to society. Fundamental knowledge about the oceans is essential to understanding the Earth's environment and how it changes over time, assessing and predicting the status of marine resources, finding beneficial new uses of ocean resources, and protecting national security.

Federal Leadership in Ocean Science and Technology

Our Commission defines ocean science and technology broadly to include: exploration of new ocean environments; basic and applied research to increase understanding of the biology, chemistry, physics, and geology of the oceans and coasts, their interactions with terrestrial, hydrologic, and atmospheric systems, and the interactions between ocean and coastal regions and humans; and the development of new methodologies and instruments.

Today, 15 Federal agencies support or conduct diverse activities in ocean science, technology, assessment, and management. The heads of these agencies direct the National Oceanographic Partnership Program (NOPP), which coordinates national oceanographic research and education. NOPP has provided a useful venue for agencies to support a small number of ocean science and technology projects, but it has not realized its full potential as an overarching mechanism for coordination among Federal agencies and State, local, academic, and private entities.

Under the proposed National Ocean Policy Framework, the National Ocean Council's Committee on Ocean Science, Education, Technology, and Operations (COSETO) will assume leadership of NOPP to implement a broad national strategy for ocean research, education, observation, exploration, and marine operations. NOPP's existing offices and committees will be incorporated within this structure. Ocean.US, the lead office for planning the Integrated Ocean Observing System (IOOS), and the Federal Oceanographic Facilities Committee which provides advice on oceanographic facilities, will both report to COSETO.

Creating a National Strategy for Ocean Science and Technology

The United States needs a national strategy for ocean and coastal research, exploration, and marine operations that can help meet the ocean resource management challenges of the 21st century and ensure that useful products result from Federal investments in ocean research. Much more needs to be known about how marine ecosystems function on varying spatial scales, how human activities affect marine ecosystems and how, in turn, these changes affect human health. Coordinated and enhanced research activities and marine operations are needed to: understand biological, physical, and chemical processes and interactions; maintain overall ecosystem health and biological diversity; observe, monitor, assess, and predict environ-

mental events and long-term trends; explore the ocean depths for new resources; and map ocean and coastal areas for safe navigation and resource management.

Furthermore, the ocean and coastal environment is rife with conflicts among competing users and between groups of people applying different sets of values to the same issues. To resolve these conflicts, information is needed not only about the natural environment but also about relevant social, cultural, and economic factors.

Better coordination and increased support of ocean science and technology activities nationwide will help the United States to address numerous management challenges, and will position the nation to quickly tackle new issues as they emerge.

Advancing Ocean and Coastal Research

The United States has a wealth of ocean research expertise spread across a network of government and industry laboratories and world-class universities, colleges, and marine centers. With strong Federal support, these institutions made the United States the world leader in oceanography during the 20th century. However, a leader cannot stand still. Ocean and coastal management issues continue to grow in number and complexity, new fields of study have emerged, new interdisciplinary approaches are being tried, and there is a growing need to understand the ocean on a global and regional scale. All this has created a corresponding demand for high-quality scientific information. And while the need for increased information continues to grow, the Federal investment in ocean research has stagnated in recent decades.

The current annual Federal investment in marine science is well below the level necessary to address adequately the nation's needs for coastal and ocean information. Unless funding increases sharply, the gap between requirements and resources will continue to grow and the United States will lose its position as the world's leader in ocean research.

Congress should double the Federal ocean and coastal research budget over the next five years, from the 2004 level of approximately $650 million to $1.3 billion per year. As part of this increase, the National Ocean Council or Congress should: fund the research component of the regional ocean information programs to provide practical, management-oriented information at regional, State, and local levels; create a national program for social science and economic research to examine the human dimensions and economic value of the nation's oceans and coasts, with funding of at least $8–$10 million a year; establish a joint Oceans and Human Health Initiative funded at $28 million a year; and significantly increase the budget of the National Sea Grant College Program.

To ensure that increased investments are used wisely and that important research activities continue, Federal agencies will need to create long-term strategic plans. A mechanism is required to coordinate federally-funded ocean research, support long-term projects, and create partnerships throughout all agencies and sectors. Transparent and comprehensive research plans would achieve these goals and ensure that research results can be translated into operational products in a timely manner. The National Ocean Council should develop a national ocean research strategy that reflects a long-term vision, promotes advances in basic and applied ocean science and technology, and guides relevant agencies in developing ten-year science plans and budgets.

Ocean Exploration

About 95 percent of the ocean floor remains unexplored, much of it located in harsh environments such as the polar latitudes and the Southern Ocean. Experience teaches us, however, that these vast and remote regions teem with undiscovered species and resources. On virtually every expedition, oceanographers discover fascinating new creatures. Advances in deep-sea technologies have also made it easier to locate shipwrecks and historical artifacts lost in the ocean depths, such as the stunning discovery of the RMS Titanic in 1985. The continued exploration of marine archaeological sites will help us to better understand human history and our global cultural heritage.

Very little is known about the ocean depths due primarily to the lack of a long-term, large-scale national commitment to ocean exploration. In 2000, recommendations from the President's Panel on Ocean Exploration led to the establishment of the Office of Exploration within NOAA, at a modest funding level of $4 million in fiscal year 2001, and $14 million in each of fiscal years 2002 and 2003. This program is helping NOAA to fulfill its applied science, environmental assessment, and technology development responsibilities; although the program's small budget and agency-specific focus limit its effectiveness.

NOAA and NSF, by virtue of their missions and mandates, are well positioned to lead a global U.S. ocean exploration effort. NOAA currently runs the Office of

Ocean Exploration, but NSF's focus on basic research provides an excellent complement to NOAA's more applied mission. Working together, the two agencies have the capacity to systematically explore and conduct research in previously unexamined ocean environments. To succeed, coordination, joint funding, and interactions with academia and industry will be essential. Congress should appropriate significant funding for an expanded national ocean exploration program and the National Oceanic and Atmospheric Administration and the National Science Foundation should be designated as the lead agencies. An expanded national ocean exploration program will require a budget of approximately $110 million annually, plus additional funds for required infrastructure.

Mapping, Charting, and Assessments

The need for routine mapping, monitoring, and assessment of U.S. waters has grown significantly in the past two decades. Accurate, up-to-date maps and charts of harbors, coastlines, and the open ocean are necessary for many activities, including shipping, military operations, and scientific research. In addition, expanded regulatory regimes rely heavily on routine assessments of living and nonliving marine resources and water quality. Modern sensor technologies, which can detect new variables in greater detail in the water column and seafloor, have improved our ability to follow changing ocean and terrestrial dynamics. But as these new technologies are implemented, they need to be calibrated against previous methods, as well as with each other, to provide useful environmental characterizations and ensure the consistency of long-term statistical data sets.

At least ten Federal agencies, almost all coastal states, and many local agencies, academic institutions, and private companies are involved in mapping, charting, and assessing living and nonliving resources in U.S. waters. However, different organizations use varying methods for collecting and presenting these data, leading to disparate products that contain gaps in the information they present. Ideally, a variety of information (e.g., bathymetry, topography, bottom type, habitat, salinity, vulnerability) should be integrated into maps using Global Positioning System coordinates and a common geodetic reference frame. In addition, these maps should include living marine resources, energy resources, and environmental data when available, to create complete environmental characterizations necessary for developing and implementing science-based ecosystem-based management approaches.

Coordination of the many existing Federal mapping activities will increase efficiency and help ensure that all necessary surveys are conducted. Drawing upon the mapping and charting abilities found in the private sector and academia will also be necessary to achieve the best results at the lowest cost.

The National Ocean Council should coordinate Federal ocean and coastal resource assessment, mapping, and charting activities with the goal of creating standardized, easily accessible national maps that incorporate living and nonliving marine resource data along with bathymetry, topography, and other natural features.

Achieving a Sustained, Integrated Ocean Observing System

About 150 years ago, this nation set out to create a comprehensive weather forecasting and warning network and today most people cannot imagine living without constantly updated weather reports. Recognizing the enormous national benefits that have accrued from the weather observing network, it is time to invest in a similar observational and forecasting capability for the oceans. This system would gather information on physical, geological, chemical, and biological parameters for the oceans and coasts, conditions that affect—and are affected by—humans and their activities. The United States currently has the scientific and technological capacity to develop a sustained, national Integrated Ocean Observing System (IOOS) that will support and enhance the nation's efforts for: improving the health of our coasts and oceans; protecting human lives and livelihoods from marine hazards; supporting national defense and homeland security efforts; measuring, explaining, and predicting environmental changes; and providing for the sustainable use, protection, and enjoyment of ocean resources.

The National Ocean Council should make the development and implementation of a sustained, national Integrated Ocean Observing System a central focus of its leadership and coordination role. The United States simply cannot provide the economic, environmental, and security benefits listed above, achieve new levels of understanding and predictive capability, or generate the information needed by a wide range of users, without implementing the IOOS.

The IOOS is based on two components: (1) open ocean observations conducted in cooperation with the international Global Ocean Observing System (GOOS) and (2) a national network of coastal observations conducted at the regional level. The

coastal component will include the U.S. exclusive economic zone, the Great Lakes, and coastal and estuarine areas.

A strong national governance structure is required to establish policy and provide oversight for all components of the IOOS and to ensure strong integration among the regional, national, and global levels. Interagency coordination and consensus through the National Ocean Council and Ocean.US will be essential. While regional systems will retain a level of autonomy, achievement of the IOOS with nationwide benefits will require the regional systems to follow some national guidelines and standards. In addition, developers of the IOOS must ensure that the global component is not minimized and that the connectivity with the GOOS, including U.S. funding and leadership, remains strong and viable.

Formalizing Ocean.US

Ocean.US has made significant progress as the lead organization for the design and implementation of the national IOOS. However, a fundamental problem current exists in that Ocean.US has a number of responsibilities without any real authority or control over budgets. Its ephemeral existence under the Memorandum of Agreement which created it, its dependence on personnel detailed from the member agencies, and its lack of a dedicated budget severely detract from its stature within the ocean community and its ability to carry out its responsibilities. Congress should formally establish Ocean.US under the National Ocean Council structure so that it may effectively advise the NOC and achieve its coordination and planning mandates. The office requires consistent funding and dedicated full-time staff with the expertise and skills needed to ensure professional credibility. In addition, outside experts on rotational appointments could help Ocean.US better meet its responsibilities.

Coordinating Regional Observing Systems

Ocean.US envisions the creation of a nationwide network of regional ocean observing systems that will form the backbone of coastal observations for the IOOS. Although Ocean.US has proposed the creation of Regional Associations, coordinated through a national federation, as the governing bodies of the regional systems, this concept is unnecessarily narrow. To fully address the needs of coastal managers, ocean observations need to be integrated into other information gathering activities such as regionally-focused research, outreach and education, and regional ecosystem assessments. Thus, the proposed regional ocean information programs provide a more comprehensive mechanism for developing and implementing regional ocean observing systems, in coordination with their broader responsibilities. Regular meetings among all the regional ocean information programs and Ocean.US will be important for providing regional and local input into developing requirements of the national IOOS.

Reaching Out to the User Community

The IOOS must meet the needs of a broad suite of users, including the general public. To get the most out of the IOOS, resource managers at Federal, State, regional, territorial, tribal, and local levels will need to supply input about their information needs and operational requirements and provide guidance on what output would be most useful. Other users, including educators, ocean and coastal industries, fishermen, and coastal citizens, must also have a visible avenue for providing input. Ocean.US and the regional ocean information programs will need to devote significant time and thought to proactively approaching users and promoting public awareness of the enormous potential of the IOOS.

Planning Space-based Observations

An integral part of the national IOOS are the space-borne sensors that provide comprehensive, real-time, widespread coverage of ocean conditions and features. However, implementing sustained observations from space requires intense planning with long lead times. Given the cost, the time frame for constructing and launching satellites, and the inability to modify satellites once in orbit, five- to ten-year plans are required to ensure that satellite observations will be available on a continuous basis and employ the most useful and modern sensors. Ocean.US and NOAA must work with NASA to ensure that ongoing satellite operations are fully integrated into the national IOOS.

Both NOAA and NASA currently operate civilian, space-based, Earth observing programs that measure terrestrial, atmospheric, and oceanic variables. NOAA's primary mission in this area is to provide sustained, operational observations for monitoring and predicting environmental conditions and long-term changes, with a focus on weather and climate. In contrast, NASA's mission is to advance research efforts and sensor development. A NASA project can last from a few days to a few years,

and NASA has repeatedly asserted that it is not in the business of providing data continuity. In many instances, the lifetime of a NASA satellite, and its continued ability to collect and transmit data, outlasts its funding, resulting in premature termination at odds with the pressing demands for data in the operational context. Thus NASA's efforts have not, and will not, result in the sustained capabilities needed for the national IOOS. Congress should transfer the operation of NASA's Earth environmental observing satellites, along with associated resources, to NOAA to achieve continuous data collection. NOAA and NASA should work together to plan future missions and then ensure the smooth transition of each Earth environmental observing satellite after its launch. By consolidating Earth, and particularly ocean, observing satellite missions in NOAA, more seamless, long-term planning will be possible, resulting in a smooth concept-to-operations data collection process.

Information Product Development

To justify large Federal investments in the IOOS, the system must result in tangible benefits for a broad and diverse user community, including the general public, scientists, resource managers, emergency responders, policymakers, private industry, educators, and officials responsible for homeland security. National Weather Service and commercial meteorological products have applications ranging from scientific research to human safety, transportation, agriculture, and simple daily forecasts. Similarly, IOOS products should be wide-ranging and based on the needs of regional and local organizations and communities, as well as national needs. The regional ocean information programs should help produce information products of benefit to regional, State, and local managers and organizations. These regional programs will also provide important feedback to national forecasters and modelers about ways to make national IOOS products more useful.

Funding the IOOS

To fulfill its potential, the IOOS will require stable funding over the long haul. The lack of long-term funding for existing regional ocean observing systems has contributed to their isolation and piecemeal implementation. But consistent funding will help ensure that the American public receives the greatest return for its investment in the form of useful information, reliable forecasts, and timely warnings. The estimated start-up costs for the implementation of the national IOOS over the first five years is close to $2 billion.

Continuous improvements to IOOS observation and prediction capabilities will also require sustained investments in technology development. Considering the costs of sensor development, telecommunications, computer systems, and improvements in modeling and prediction capabilities, annual costs for operating, maintaining, and upgrading the national IOOS are estimated to be $650–$750 million a year.

Whole Earth Observations

The IOOS cannot exist as a stand-alone system, developed without considering associated observations. Rather, it should be integrated with other environmental observing systems to link weather, climate, terrestrial, biological, watershed, and ocean observations into a unified Earth Observing System. The National Ocean Council should oversee coordination of the IOOS with other existing and planned terrestrial, watershed, atmospheric, and biological observation and information collection systems, with the ultimate goal of developing a national Earth Observing System. Such a system would improve understanding of environmental changes, processes, and interactions, making ecosystem-based management possible.

Enhancing Ocean Infrastructure and Technology Development

A robust infrastructure with cutting-edge technology forms the backbone of modern ocean science. It supports scientific discovery and facilitates application of those discoveries to the management of ocean resources. The nation has long relied on technological innovation, including satellites, early-warning systems, broadband telecommunications, and pollution control devices to advance economic prosperity, protect life and property, and conserve natural resources. Ocean research, exploration, mapping, and assessment activities will continue to rely on modern facilities and new technologies to acquire data in the open ocean, along the coasts, in polar regions, on the seafloor, and even from space.

The three major components of the nation's scientific infrastructure for oceans and coasts are:

—Facilities—land-based laboratories and ocean platforms, including ships, airplanes, satellites, and submersibles, where research and observations are conducted;

—Hardware—research equipment, instrumentation, sensors, and information technology systems used in the facilities; and

—Technical Support—the expert human resources needed to operate and maintain the facilities and hardware as well as participating in data collection, assimilation, analysis, modeling, and dissemination.

The number and types of assets included in the national ocean science infrastructure are extensive and cover a wide range of Federal, State, academic, institutional, and private-sector entities.

Together, they represent a substantial public and private investment that has made possible great strides in modern oceanography over the last 50 years. But a recent assessment of these assets revealed that significant components of the U.S. ocean infrastructure are aged or obsolete and that, in some cases, current capacity is insufficient to meet the needs of the ocean science and operational community. The National Ocean Council's Committee on Ocean Science, Education, Technology, and Operations should develop a national ocean and coastal infrastructure and technology strategy to achieve and maintain an appropriate mix of federally-supported, modern ocean facilities that meet the nation's needs for quality resource management, science, and assessment.

Funding Needed Assets

There are currently several critically needed components of the ocean science and technology infrastructure, including: Surface vessels, such as new University National Oceanographic Laboratory System vessels and fishery research ships; undersea vehicles, including an array of manned, remotely operated, and autonomous submersibles; aircraft, both manned and unmanned; modern laboratories and instrumentation; dedicated ocean exploration platforms; telecommunications technology; and environmental and biological sensors.

Congress should establish a modernization fund to support these critical ocean infrastructure and technology needs. Such a fund would be used to build or upgrade facilities and acquire related instrumentation and equipment. It would also provide a mechanism to coordinate similar equipment purchases across agencies, where feasible, creating significant economies of scale. Current and future spending priorities for the fund should be based on the National Ocean Council's ocean and coastal infrastructure and technology strategy.

Transferring Technology

The development of needed ocean technologies—whether identified by the national strategy or through interagency communication—requires directed funding and coordination. Federal agency programs will benefit by having a centralized office responsible for accelerating the transition of technological advances made by Federal and academic laboratories into routine operations.

NOAA should create, and Congress should fund, an Office of Technology to expedite the transition of experimental technologies into operational applications. This office should work closely with academic institutions, the regional ocean information programs, the National Science Foundation, the U.S. Navy, the National Aeronautics and Space Administration, and other relevant agencies to achieve this mission.

Modernizing Ocean Data and Information Products

Ocean and coastal data are essential for understanding marine processes and resources. They are the foundation for the science-based information on which resource managers depend. But storing and processing large amounts of data, and converting them into information products useful to a broad community of end users, remains a huge challenge.

There are two major challenges facing data managers today: the exponentially growing volume of data, which continually strains data ingestion, storage, and assimilation capabilities; and the need for timely access to these data by the user community in a variety of useful formats. Meeting these challenges will require a concerted effort to integrate and modernize the current data management system. The ultimate goal of improved ocean data management should be to effectively store, access, integrate, and utilize a wide and disparate range of data needed to better understand the environment and to translate and deliver scientific results and information products in a timely way.

Interagency Coordination

An interagency group, dedicated to ocean data and information planning, is needed to enhance coordination, effectively use existing resources for joint projects, schedule future software and hardware acquisitions and upgrades, and oversee strategic funding.

Congress should amend the National Oceanographic Partnership Act to create and fund Ocean.IT as the lead Federal interagency planning organization for ocean

and coastal data and information management. Ocean.IT should consist of representatives from all Federal agencies involved in ocean data and information management, be supported by a small office, and report to the National Ocean Council's Committee on Ocean Science, Education, Technology, and Operations.

Ocean.IT should coordinate the development of a viable, long-term data management strategy which includes:

—The implementation of an interagency plan to improve access to data at the national data centers, Distributed Active Archive Centers, and other discipline-based centers. This plan will need to be appropriately integrated with other national and international data management plans, including those for the Integrated Ocean Observing System and Global Ocean Observing System.

—Opportunities to partner with the private sector to enhance environmental data and information management capabilities.

This organization should not have an operational role, but instead should be responsible solely for interagency planning and coordination, similar to the role of Ocean.US for the IOOS.

Informational Product Development

Compared to a few decades ago, an impressive array of data and information products for forecasting ocean and coastal conditions is now available from a wide range of sources. A mechanism is now needed to bring these data together, including the enormous amounts of information that will be generated by the national IOOS, and use these data to generate and disseminate products beneficial to large and diverse audiences.

The National Oceanic and Atmospheric Administration and the U.S. Navy should establish a joint ocean and coastal information management and communications program to generate information products relevant to national, regional, State, and local needs on an operational basis. This program should build on the Navy's model for operational oceanography and take advantage of the strengths of both agencies to reduce duplication and more effectively meet the nation's information needs. This partnership will also allow for the prompt incorporation of classified military data into informational products without publicly releasing the raw data. A NOAA-Navy joint program would rapidly advance U.S. coastal and ocean analyses and forecasting capabilities using all available physical, biological, chemical, and socio-economic data.

Interactions between private companies and the NOAA-Navy national ocean and coastal information management and communications program could lead to the production of a wide range of general and tailored forecast and warning products. An interface between national forecasters at the NOAA-Navy program and the regional ocean information programs would also help identify ocean and coastal informational products of particular value at the regional and local levels.

PROMOTING LIFELONG OCEAN EDUCATION

Education has provided the skilled and knowledgeable workforce that made America a world leader in technology, productivity, prosperity, and security. However, the emergence of rampant illiteracy about science, mathematics, and the environment now threaten the future of America, its people, and the oceans on which we rely.

Testing results suggest that, after getting off to a good start in elementary school, by the time U.S. students graduate from high school their achievement in math and science falls well below the international average. Ocean-related topics offer an effective tool to keep students interested in science, increase their awareness of the natural world, and boost their academic achievement in many areas. In addition, the links between the marine environment and human experience make the oceans a powerful vehicle for teaching history, culture, economics, and other social sciences. Yet teachers receive little guidance on how they might use exciting ocean subjects to engage students, while adhering to the national and State science and other education standards that prescribe their curricula.

In addition, a 1999 study indicated that just 32 percent of the nation's adults grasp simple environmental concepts, and even fewer understand more complex issues, such as ecosystem decline, loss of biodiversity, or watershed degradation. It is not generally understood that nonpoint source pollution threatens the health of our coastal waters, or that mercury in fish comes from human activities via the atmosphere. Few people understand the tangible value of the ocean to the nation or that their own actions can have an impact on that resource. From excess applications of fertilizers, pesticides, and herbicides on lawns, to the trash washed off city streets into rivers and coastal waters, ordinary activities contribute significantly to the degradation of the marine environment. Without an acknowledgement of the impacts associated with ordinary behavior and a willingness to take the necessary ac-

tion—which may incur additional costs—achieving a collective commitment to more responsible lifestyles and new policies will be difficult.

Excellent lifelong education in marine affairs and sciences is essential to raising public awareness of the close connection between the oceans and humans, including our history and culture. This awareness will result in better public understanding of the connections among the ocean, land, and atmosphere, the potential benefits and costs inherent in resource use, and the roles of government and citizens as ocean stewards.

Ocean Stewardship

To successfully address complex ocean- and coastal-related issues, balance the use and conservation of marine resources, and realize future benefits from the ocean, an interested, engaged public will be needed. The public should be armed not only with the knowledge and skills needed to make informed choices, but also with a sense of excitement about the marine environment. Individuals should understand the importance of the ocean to their lives and should realize how individual actions affect the marine environment. Public understanding of human impacts on the marine environment should be balanced with recognition of the benefits to be derived from well-managed ocean resources. Because of the connection among the ocean, the atmosphere, and the land, inland communities need to be just as informed as seaside communities.

Science Literacy

Ocean-related education has the potential to stem the tide of science illiteracy threatening to undermine the nation's health, safety, and security. Children have a natural curiosity about the world around them and this allure could be parlayed into higher achievement in other subjects as well. The influence of the ocean on nearly every aspect of daily life, and the central role it plays in the development of the nation, make ocean-based studies ideal for enhancing student performance in areas such as geography, history, economics, policy, and law. Strengthening science literacy, therefore, encompasses not only natural sciences, but a full suite of social sciences.

Future Ocean Leaders

The nation needs a diverse, knowledgeable, and adequately prepared workforce to enhance understanding of the marine environment and make decisions regarding complex ocean- and coastal-related issues. The education of the 21st century ocean-related workforce will require not only a strong understanding of oceanography and other disciplines, but an ability to integrate science concepts, engineering methods, and sociopolitical considerations. Resolving complex ocean issues related to economic stability, environmental health, and national security will require a workforce with diverse skills and backgrounds. Developing and maintaining such a workforce will rely, in turn, on programs of higher education that prepare future ocean professionals at a variety of levels and in a variety of marine-related fields.

Coordinating Ocean Education

Although not all ocean-related Federal agencies have a specific education mission, most have made efforts to reach out to students, teachers, and the public to inform them about ocean issues, sometimes by adding ocean-related components to larger science and environmental education efforts. And while it is valuable for ocean-related information to be included as part of broader environmental and science education efforts, it is also important to support educational efforts that focus specifically on oceans, coasts, and the human relationship with them.

Federal programs can provide many opportunities for ocean-related education, but ultimately education is a State responsibility, and control is exerted primarily at the local level. Therefore, the interaction between education administrators at the State, district, and individual school levels and Federal agencies will be fundamental to the success of any effort to use ocean-based examples to enhance student achievement. Aquariums, zoos, and other informal education centers also provide the public with opportunities to learn about the marine environment and should be integral components of a national effort to increase ocean-related education.

Despite the existence of many positive efforts, ocean education remains a patchwork of independently conceived and implemented programs and activities. These efforts cannot provide the nationwide momentum and visibility needed to promote sustained ocean education for students, teachers, and the general public. Within the Federal Government, there is little discussion of ocean education, even among those agencies with the greatest responsibility for ocean issues. Different programs and funding mechanisms are not coordinated and resources are seldom leveraged. Even

within individual agencies, offices that have education components often do not collaborate or communicate.

To strengthen ocean education and coordinate Federal education efforts, the National Ocean Council should establish a national ocean education office (Ocean.ED) under its Committee on Ocean Science, Education, Technology, and Operations. This office should coordinate and integrate Federal agency programs and leverage resources; serve as a central, visible point of contact for K–12, university-level, and informal education partners; and work with all parties to develop coherent, comprehensive planning for ocean education efforts.

To fulfill its coordination activities, Congress should provide dedicated funding for Ocean.ED operations and program implementation. However, this national effort is not meant to replace other successful programs and activities, but rather provide a mechanism for communication, coordination, and joining of forces.

Developing Ocean Curricula

The value of ocean-based learning must be recognized within local school districts to create a demand for ocean-related education products. Federal, regional, State, and local education professionals need to advocate for the inclusion of ocean-based examples in State and local education requirements and testing. Collaborative efforts will be needed to develop research-based, ocean-related curricular materials that are aligned with State and national educational standards and meet the needs of teachers. Ocean.ED, working with State and local education authorities and the research community, should coordinate the development and adoption of ocean-related materials and examples that meet existing education standards.

Teaching the Teachers

Higher expectations for our youth mean higher expectations for teachers as well. Students cannot achieve without instruction by capable teachers who are knowledgeable in the topics being presented. Thus, improving the quality of science and math education must begin with improving preparation of undergraduates studying to be teachers (referred to as pre-service teachers) and professional development for certified teachers in the classroom (referred to as in-service teachers).

The ocean research community is brimming with potential for engaging K–12 educators in the excitement and satisfaction of the scientific enterprise, and the nation's research infrastructure provides significant opportunities for formal preparation, hands-on involvement, and teacher certification. Although several public and private sector programs can provide teachers with research experience in ocean-related topics, access to these programs is quite limited, very few have long-term, stable funding, and the different efforts are poorly coordinated. Ocean.ED, working with academic institutions and local school districts, should help establish stronger and more effective relationships between the research and education communities to expand professional development opportunities for teachers and teacher educators.

Bringing Oceans Education to All Students

Through field and laboratory experiments, oceans offer a natural avenue for students to gain first-hand exposure to science while developing an awareness of the importance of the ocean. Not all students are near, or able to travel to, the shore, but new ocean research technologies represent a tremendous and virtually untapped avenue to overcome this limitation, allowing students anywhere to be involved in real oceanographic investigations. The same remote-access technologies that make advanced ocean research possible can also help students and teachers participate in collecting, analyzing, and distributing ocean data. Enabling students to interact with practicing scientists, even if they are thousands of miles away, can help create a lifelong affinity for learning.

Social, economic, and cultural factors can also play an influential role in inhibiting a student's access to education opportunities, especially science-based opportunities. These factors are unusually strong among minority students and other groups that have been traditionally underrepresented and underserved in scientific fields, including marine sciences. Repairing this broken link will depend on exposing minority students to ocean-related studies early in their education, continuing that exposure throughout their school years, and demonstrating the possibilities and rewards of a career in ocean-related fields.

Federal agencies and academic institutions should find ways to provide all students with opportunities to participate in ocean research and exploration, virtually or in person, including summer programs, field trips, remote participation in ocean expeditions, and, most important, after-school activities. Mentoring, especially near-peer guidance, is critical and should be a component of any student-oriented program. Ocean.ED should promote partnerships among school districts, institutions of higher learning, aquariums, science centers, museums, and private laboratories to

develop more opportunities for students to explore the marine environment, both through virtual means and hands-on field, laboratory, and at-sea experiences. Ocean.ED should also ensure that ocean-based educational programs and materials acknowledge cultural differences and other aspects of human diversity, resulting in programs that expose students and teachers from all cultures and backgrounds to ocean issues.

Drawing Students into the Field of Ocean Science and Management

The ocean community must compete with countless other professions in attracting the talent it needs. Success lies, in part, in promoting marine-related career opportunities among undergraduate students from a broad range of disciplines. Firsthand experiences in marine fields can be influential in demonstrating the possibilities and rewards of an ocean-related career.

Intellectually stimulating and financially attractive options for pursuing graduate studies in an ocean-related field must follow, so a student's developing interest in ocean studies is not overshadowed by other professions that actively pursue, encourage, and support their future leaders. Ocean sciences have another potentially important role to play at the undergraduate level. Marine science courses can be attractive options for non-science majors who need to fulfill science requirements for graduation, presenting an excellent opportunity to raise general ocean awareness.

The National Oceanic and Atmospheric Administration, National Science Foundation, and Office of Naval Research should support colleges and universities in promoting introductory marine science courses to expose students, including non-science majors, to these subjects.

Training Ocean Professionals

Because ocean science is fundamentally interdisciplinary, well-trained ocean professionals can find excellent careers in many areas including engineering, economics, education, law, management, policy, science, and technology. Individuals considering or pursuing graduate studies in a marine field should be aware of these options, and exploration of nontraditional marine areas should be encouraged. Equally important, professionals educated and trained in other fields should be made aware of the exciting opportunities available to them in marine-related fields.

Ocean.ED should guide and promote the development of the nation's ocean-related workforce by: promoting student support, diversified educational opportunities, and investment in innovative approaches to graduate education that prepare students for a broad range of careers in academia, government, and industry; and encouraging graduate departments of ocean sciences and engineering to experiment with new or redesigned programs that emphasize cross-disciplinary courses of study.

Complementing the need to create an adequate workforce is the need to sustain and enhance that workforce through professional development and continuing education opportunities. Learning does not stop once the formal education process is complete; ocean professionals in all fields must be provided the means and liberty to continually build upon their knowledge and skills throughout their careers.

Informing the Public

Public information needs are as varied as our population is diverse. Some individuals will benefit from detailed information on how specific issues directly affect their jobs or business. Others may need information presented in a language and media tailored to their culture and community. Still others seek advice on how to alter their own activities to support responsible ocean stewardship. This information is as critical for those who live in the heartland as for those who live near the shore.

Informal education requires outreach programs, in partnership with local communities, to make contact with individuals where they live and work, regarding issues that affect how they live and work, in a style that speaks to them. Information supplied to the public should be timely and accurate. It should also be supported by a system that allows for follow-up and the acquisition of additional information or guidance. Ocean.ED, working with other appropriate entities, should enhance existing and establish new mechanisms for developing and delivering relevant, accessible information and outreach programs to enhance community education.

Regional Outreach—Connecting the Research and Education Communities

Collaboration between the research and education communities must be improved if ocean-based information, including ocean data and new discoveries, is to be transformed into exciting and accessible materials to stimulate student achievement and enhance public awareness. Some efforts do exist to make these connections, most notably through the Centers for Ocean Sciences Education Excellence (COSEE) and National Sea Grant College Program.

COSEE

The COSEE network, supported primarily through NSF, includes regional centers and a central coordinating office that work to integrate oceanographic data and information into high-quality curricular materials, to provide ocean scientists with opportunities to learn more about educational needs and requirements, to provide K–12 teachers with the knowledge and skills they need to effectively incorporate ocean-related information into their lessons, and to deliver ocean-related information to the public. Though recognized as a model for enhancing education and bringing accessible ocean-related information to the public, COSEE currently has only seven regional centers, each serving a limited number of schools in its area. The program does not have the level of committed, long-term support required to fully realize its potential.

While COSEE is currently a National Science Foundation program, placing it within the National Ocean Council (NOC) structure would capitalize on the tremendous potential to enhance and expand the program. The NOC and the NSF should relocate COSEE within the larger NOC structure as a program to be organized, overseen, and funded through Ocean.ED. In addition, the number of COSEE regional offices should be tripled to 21 with each center receiving at least $1.5 million a year for an initial five-year period.

National Sea Grant College Program

The National Sea Grant College Program was created by Congress in 1966 as a partnership between the nation's universities and NOAA. Sea Grant programs sponsor research, education, outreach, and technology transfer through a network of Sea Grant Colleges and research institutions.

Sea Grant has forged connections between the research and education communities since its inception. Its programs provide K–12 teacher preparation and professional development programs consistent with State education standards, offer hands-on educational experiences for students, and develop research-based curricular and communications materials for students and the public. The Sea Grant network relies on longstanding local partnerships, with many connections to populations that have been traditionally underrepresented and underserved by the ocean community.

Despite its successes, however, Sea Grant is currently an underutilized resource. The existing Sea Grant network requires increased funding to expand its roles and responsibilities, particularly in education and outreach. In particular, Sea Grant extension and communications programs, familiar to many resource managers and others in coastal communities, should become the primary mechanisms for delivering and interpreting information products developed through the regional ocean information programs.

Specific Federal Responsibilities

Each Federal agency with ocean-related responsibilities—most notably NOAA, NSF, and Office of Naval Research—has a responsibility to help ensure a vibrant ocean-related workforce. These agencies need to develop interrelated and cross-cutting educational opportunities at the undergraduate, graduate, and postdoctoral levels.

National Oceanic and Atmospheric Administration

NOAA should be particularly concerned with creating a pipeline of students in areas it identifies to be of critical importance to the agency. Opportunities should include both research experiences, especially exposure to mission-oriented research, and experiences beyond the research arena. Student exposure can begin as early as the junior or senior level in high school, continuing through postdoctoral education. A range of programs will help identify and recruit the best and brightest to careers in marine-related fields and ensure a continuing source of essential human capital. At the graduate and postdoctoral levels, NOAA should support fellowships and traineeships that emphasize interdisciplinary approaches and real-world experiences beyond the university setting.

NOAA should establish a national ocean education and training program, patterned after the National Institutes of Health model, within its Office of Education and Sustainable Development to provide diverse, innovative ocean-related education opportunities at the undergraduate, graduate, and postdoctoral levels.

In addition, NOAA should establish competitive "Distinguished Professorships in Marine Studies" within Sea Grant Colleges or other leading institutions of higher education with a demonstrated commitment to marine programs. Disciplines of interest to NOAA for such professorships could include fisheries science, climate research, atmospheric studies, and marine resource economics, policy, aquaculture,

genomics, education, and ecosystem studies. The intent would be to create a cadre of distinguished NOAA endowed chairs at universities around the nation.

National Science Foundation

At the undergraduate level, NSF's Research Experience for Undergraduates program could be expanded to include more marine-related experiences. At the graduate and postdoctoral levels, opportunities could include fellowships that encourage cross-disciplinary research, interdisciplinary traineeships, and master's degree fellowships. Programs such as NSF's Integrative Graduate Education and Research Training program, Centers for Learning and Teaching, and Graduate Teaching Fellows in K–12 Education should be supported and enhanced both within NSF and adopted by other Federal ocean agencies. The National Science Foundation's Directorates of Geosciences, Biological Sciences, and Education and Human Resources should develop cooperative programs to provide diverse educational opportunities at the undergraduate, graduate, and postdoctoral levels in a range of ocean-related fields.

Office of Naval Research

The success of the Navy depends on a well-developed understanding of the environment in which it operates. Understanding the ocean environment—including the atmosphere above it, the seafloor beneath it, and the coastlines that encircle it—will always be a core naval requirement. Thus the Navy should play a central role in ensuring support for the education of future generations of ocean professionals. The Office of Naval Research should reinvigorate its support of graduate education in ocean sciences and engineering. This could be partly accomplished by increasing the number of ocean-related awards made under ONR's National Defense Science and Engineering Graduate Fellowship Program.

SPECIFIC MANAGEMENT CHALLENGES

Although the areas I discussed—improved governance through a new National Ocean Policy Framework, the incorporation of scientific information in decision-making, and broad public education—represent the overarching areas that this nation must address using the guiding principles I mentioned earlier, the U.S. Commission on Ocean Policy did not stop there in its deliberations and recommendations. The Commission also addressed a wide range of specific ocean management challenges—challenges that will continue to be addressed individually, but which now must also become part of more ecosystem based management approach, applying the guiding principles throughout the management process. These individual ocean and coastal management challenges include: Linking the management of coasts and watersheds; Protecting life and property from natural hazards; Restoring and conserving habitat; Better managing sediments and shorelines; Supporting marine commerce and transportation; Reducing water pollution from all sources, including from vessels and through the introduction of marine debris; Preventing the introduction of invasive species; Sustainably managing our fisheries; Protecting marine mammals and other marine species; Conserving corals and corals reefs; Enabling the environmentally-sound development of marine aquaculture; Understanding and safeguarding Oceans and Human Health; and, developing offshore energy resources and marine minerals.

IMPROVING MANAGEMENT OF COASTS AND WATERSHEDS

Let me begin by addressing some of the issues in our coastal areas. While coastal counties (located entirely or partially within coastal watersheds) comprise only 17 percent of the land area in the contiguous United States, they are home to more than 53 percent of the total U.S. population. Coastal population trends indicate average increases of 3,600 people a day moving to coastal counties, reaching a total population of 165 million by 2015. These figures do not include the 180 million people who visit the coast every year.

Population growth and tourism bring many benefits to coastal communities, including new jobs and businesses and enhanced educational opportunities. The popularity of ocean and coastal areas increases pressures on these environments, creating a number of challenges for managers and decisionmakers. Increased development puts more people and property at risk from coastal hazards, reduces and fragments fish and wildlife habitat, alters sedimentation rates and flows, and contributes to coastal water pollution.

The pattern of coastal growth—often in scattered and unplanned clusters of homes and businesses—is also significant. Urban sprawl increases the need for infrastructure such as roads, bridges, and sewers, degrading the coastal environment while making fragile or hazard-prone areas ever more accessible to development.

Because of the connections between coastal and upland areas, development and sprawl that occur deep within the nation's watersheds also affect coastal resources.

To reap economic benefits and mitigate pressures associated with growing coastal development, State and local governments needs more Federal support to enhance their capacity to plan for and guide growth, and to employ watershed management approaches. A complex combination of individuals and institutions at all levels of government make decisions that cumulatively affect the nation's ocean and coastal areas. These institutional processes determine where to build infrastructure, encourage commerce, extract natural resources, dispose of wastes, and protect or restore environmental attributes.

Although most coastal management activities take place at State and local levels, coastal decisionmaking is also influenced by Federal actions, including funding decisions and standard setting. Of the many Federal programs that provide guidance and support for State and local decisionmaking, some address the management of activities and resources within designated geographic areas, while others address the management of specific resources, such as fisheries or marine mammals.

The Coastal Zone Management Act (CZMA) is the Federal Government's principal tool for fostering comprehensive coastal management. The CZMA created the Coastal Zone Management Program CZM Program, a unique partnership between the Federal and coastal state governments, whose goal is to balance the conservation of the coastal environment with the responsible development of economic and cultural interests. The tools, assistance, and resources provided by the CZMA have enabled States and territories to increase their management capacity and improve decisionmaking to enhance the condition of their coastal areas.

However, the CZM Program can be strengthened in a number of ways, including by developing strong, specific, measurable goals and performance standards that reflect a growing understanding of the ocean and coastal environments and the need to manage growth in regions under pressure from coastal development. A large portion of Federal funding should be linked to program performance with additional incentives offered to States that perform exceptionally well. In addition, a fallback mechanism is needed to ensure that national goals are realized when a State does not adequately participate or perform. Finally, the landside boundaries of State coastal management programs should also be reconsidered. At a minimum, each State should set the inland extent of its coastal zone based on the boundaries of coastal watersheds.

In addition to the CZM Program, other Federal area-based coastal programs include NOAA's National Estuarine Research Reserve System and National Marine Sanctuaries Program; EPA's National Estuary Program; and Fish and Wildlife Service's Coastal Program and Coastal Barrier Resources System. These programs have made significant progress in managing coastal resources in particular locations, working with communities and decisionmakers in those areas, and fostering improved coordination between different levels of government. However, because these programs generally operate in isolation from one another, they cannot ensure effective management of all ocean and coastal resources or achievement of broad national goals. As NOAA is strengthened through the multi-phased approach described earlier, consolidation of area-based coastal resource management programs will result in more effective, unified strategies for managing these areas, an improved understanding of the ocean and coastal environment, and a basis for moving toward an ecosystem-based management approach.

Federal programs related to transportation, flood insurance, disaster relief, wetlands permitting, dredging, beach nourishment, shoreline protection, and taxation also exert a profound influence on the coast. While these laws and policies address specific issues, and have each provided societal benefits, in many cases Federal activities under their purview have inadvertently led to degradation of coastal environments. For this reason, policies should be re-evaluated to ensure consistency with national, regional, and State goals aimed at achieving economically and environmentally sustainable development.

Linking Coastal and Watershed Management

For well over a decade there has been a growing interest in watershed management. This approach addresses water quality and quantity issues by acknowledging the hydrologic connections between upstream and downstream areas and considering the cumulative impacts of all activities that take place throughout a watershed. Watersheds are optimal organizing units for dealing with the management of water and closely related resources. The benefits of a watershed focus have also been recognized at the state, regional, national, and international levels through successful efforts such as the Chesapeake Bay Program, the Delaware River Basin

Commission, and the bi-national Great Lakes Commission. At the Federal level, EPA has supported efforts to address a variety of problems at the watershed level.

Many watershed groups are formed at the local level by community members concerned about water quality or the health of fish and wildlife populations. Often, these groups work to improve watershed health through partnerships among citizens, industry, interest groups, and government. However, the environmental and political characteristics of the nation's watersheds vary tremendously, and watershed management initiatives can differ widely in size and scope. As interest in watershed management continues to grow, so does the need for a framework to guide such initiatives and evaluate their effectiveness.

The Federal Government can play an important role by helping to develop this framework and by providing assistance to States and communities for watershed initiatives. Congress should amend the Coastal Zone Management Act, the Clean Water Act, and other Federal laws where appropriate, to provide better financial, technical, and institutional support for watershed initiatives and better integration of these initiatives into coastal management.

Assessing the Growing Cost of Natural Hazards

The nation has experienced enormous and growing losses from natural hazards. Conservative estimates, including only direct costs such as those for structural replacement and repair, put the nationwide losses from all natural hazards at more than $50 billion a year, though some experts believe this figure represents only half or less of the true costs. More accurate figures for national losses due to natural hazards are unavailable because the United States does not consistently collect and compile such data, let alone focus on specific losses in coastal areas. Additionally, there are no estimates of the costs associated with destruction of natural environments.

Many Federal agencies have explicit operational responsibilities related to hazards management, while numerous others provide technical information or deliver disaster assistance. The nation's lead agencies for disaster response, recovery, mitigation, and planning are the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE). These agencies implement programs that specifically target the reduction of risks from natural hazards. NOAA and USFWS also have a significant influence on natural hazards management.

Opportunities for improving Federal natural hazards management, include: Amending Federal infrastructure policies that encourage inappropriate development; Augmenting hazards information collection and dissemination; Improving the National Flood Insurance Program (NFIP); and Undertaking effective and universal hazards mitigation planning.

Conserving and Restoring Coastal Habitat

The diverse habitats that comprise the ocean and coastal environment provide tangible benefits such as buffering coastal communities against the effects of storms, filtering pollutants from runoff, and providing a basis for booming recreation and tourism industries. These habitats also provide spawning grounds, nurseries, shelter, and food for marine life, including a disproportionate number of rare and endangered species.

As more people come to the coast to live, work, and visit, coastal habitats face increasing pressures. Most human activities in coastal areas provide distinct societal benefits, such as dredging rivers and harbors to facilitate navigation, converting forests and wetlands for agriculture and development, and building dams for flood control and hydropower. But these activities can also degrade coastal habitats and compromise their ability to adapt to environmental changes.

Conserving valuable ocean and coastal areas protects significant habitat and other natural resources. Millions of coastal acres have been designated for conservation by various levels of government, and the tools for implementing conservation programs are found in a multitude of statutes. A number of Federal programs aim to preserve the natural attributes of specific areas while providing varying levels of access to the public for educational, recreational, and commercial purposes. In addition, nonregulatory conservation techniques—including fee simple land acquisition, the purchase or donation of easements, tax incentives and disincentives, and tradable development rights—play a special role in enabling willing landowners to limit future development on their land for conservation purposes. Land acquisition and easements are often implemented through partnerships among governments, nongovernmental organizations such as land trusts, and the private sector. Funding and support for continued conservation of coastal and estuarine lands is important to ensure the ability to maintain critical habitats and the benefits they provide.

Conservation is cost-effective, avoiding the much larger expense and scientific uncertainties associated with attempting to restore habitats that have been degraded or lost. Even so, once critical habitat has been lost, or the functioning of those areas diminished, restoration is often needed. Habitat restoration efforts are proliferating in response to heightened public awareness of and concern for the health of the nation's oceans and coasts.

Restoration efforts, particularly large-scale projects, are challenging in a number of ways. First, the success of these efforts requires an understanding about how to recreate natural systems and restore historical ecosystem functions, a field still in its infancy. Second, these efforts cross political boundaries and affect a broad range of human activities, requiring support and intense coordination among a wide range of governmental and nongovernmental stakeholders. While some restoration projects have been successful, continued progress will depend on sustained funding, government leadership and coordination, scientific research, and stakeholder support.

In addition to the large-scale, regional restoration efforts, there are numerous small-scale efforts that collectively make significant contributions. These activities often demonstrate the power of public-private partnerships, bringing together community members, government agencies, and businesses to solve common problems. However, as long as each project continues to be planned and implemented in isolation, its overall impact will be constrained.

Currently the many entities that administer conservation and restoration activities operate largely independently of one another, with no framework for assessing overall benefits in an ecosystem-based context. The multitude of disjointed programs prohibits a comprehensive assessment of the progress of conservation and restoration efforts and makes it difficult to ensure the most effective use of limited resources. An overarching national strategy that sets goals and priorities can also enhance the effectiveness of individual efforts and provide a basis for coordinating measures and evaluating progress of both habitat conservation and restoration activities.

Managing Sediment and Shorelines

Sediment in Great Lakes, coastal, and ocean waters is composed of inorganic and organic particles created through erosion, decomposition of plants and animals, and human activities. Sediment may be carried by wind or water from upland areas down to coastal areas, or may originate in the marine environment. Once sediment arrives at the ocean, it is transported by wind, waves, and currents in dynamic processes that constantly build up and wear away cliffs, beaches, sandbars, inlets, and other natural features.

From a human perspective, sediment has a dual nature—desirable in some locations and unwanted in others. Sediment can be used to create or restore beaches and to renew wetlands and other coastal habitats. Such activities are referred to as beneficial uses. Undesirable sediment can cloud water and degrade wildlife habitat, form barriers to navigation, and contaminate the food chain for marine plants, animals and humans.

The dual nature of sediment as both a threat and a resource to humans and the environment makes its management particularly challenging. To complicate matters further, the natural processes that create, move, and deposit sediment operate on regional scales, while management tends to focus on discrete locations—a single beach, wetland, or port. In addition, the policies that affect sediment location, transport, and quality fall under the jurisdiction of diverse programs within multiple agencies at all levels of government. This complex governance approach makes it difficult to manage sediment at the appropriate scale and in consonance, rather than in conflict, with natural processes.

Coastal stakeholders have increasingly recognized the need to develop more proactive and preventive strategies. However, their absence from broad watershed planning efforts—where decisions about land use and water management could reduce excess and contaminated sediments at their source—makes such change difficult to realize. The nation needs both a better understanding of the interactions between human activities and sediment flows, and a better mechanism for involving all potentially affected parties.

Moving toward an ecosystem-based management approach is a critical step. Participation by Federal, State, and local entities in watershed management efforts, along with key stakeholders such as coastal planners and port managers, is one way to diminish upland sources of excess and contaminated sediment that harm the marine environment. Ecosystem considerations should be included in the process for permitting any activity that alters sediment flows.

Dredged materials have long been used to create new land for commercial, residential, and infrastructure developments, as well as to bolster beaches and barrier

islands to protect against storm and erosion hazards and enhance tourism and recreation. Since the 1970s, these beneficial uses of dredged materials have also included environmental enhancement, such as restoration of wetlands, creation of wildlife habitat, and improvement of fish habitat. Surprisingly, navigation-related dredged materials do not find their way into beneficial use projects as often as perhaps they should. This is due in part to sediment contamination, but also to USACE policies that favor disposal in open waters or in upland dump sites. These policies may be unnecessarily foregoing opportunities to support economic growth or environmental protection and may have serious unintentional consequences for aquatic ecosystems. A more accurate system for selecting and ranking projects would be based on a comparative net economic and environmental return for the United States rather than a narrow cost-benefit analysis for a specific project.

Finally, the characterization, containment, removal, and treatment of contaminated sediment continue to be technically difficult and prohibitively expensive, and point to the importance of adopting an adaptive management approach to the problem. Scientifically sound methods for identifying contaminated sediment and developing innovative technologies to improve dredging and treatment of this material are critical steps toward improving the economic and ecological health of coastal areas. To be successful, these efforts will require new resources and effective regional planning.

Supporting Marine Commerce and Transportation

As the world's largest trading nation, the United States imports and exports more merchandise than any other country and has one of the most extensive marine transportation systems in the world. U.S. marine import-export trade is an essential and growing component of the national economy, accounting for nearly seven percent of the nation's gross domestic product. Domestically, coastal and inland marine trade amounts to roughly one billion tons of cargo, worth more than $220 billion a year. The marine transportation system itself is a highly complex public-private sector partnership consisting of an interconnected mix of waterways, ports and terminals, water-based and land-based intermodal connections, vessels, vehicles, equipment, personnel, support service industries, and users.

For the nation's marine transportation system to meet current and future demands, ongoing maintenance, improvement, and expansion will be required. A key prerequisite for a robust system is better coordination, planning, decisionmaking and allocation of resources at the Federal level. In particular it will be essential to enhance the connections between this system and other modes of transportation, such as highways, railways, and airports. At the same time, in moving toward an ecosystem-based management approach, planning for the movement of cargo and passengers should be coordinated with the management of many other ocean and coastal uses and activities, and with efforts to protect the marine environment.

Within the Federal Government, responsibilities for marine commerce and transportation are spread among numerous agencies, primarily the U.S. Department of Transportation (DOT), U.S. Coast Guard, USACE, NOAA, U.S. Customs Service, and EPA. These agencies have many roles, including vessel traffic management, national security, marine safety, waterway maintenance, environmental protection, and customs. These responsibilities are poorly coordinated and do not mesh well with the structure and function of such system. Statutory, regulatory, and policy differences among Federal agencies with roles in marine transportation lead to fragmentation, competition, and in some cases, an inability to work collaboratively due to conflicting mandates. National leadership and support will be needed to achieve better integration within the Federal government, better links with the rest of the nation's transportation infrastructure, and coordination between marine transportation and other important ocean and coastal uses and activities. The logical agency to assume this responsibility, as it does for the highway, aviation, and railway systems, is DOT.

Even with one clearly mandated lead Federal agency, coordination will be needed among the Federal and non-Federal participants in the marine transportation system. Given the significance of domestic and international trade to the nation and the complexity of the components that make up the system the Interagency Committee for the Marine Transportation System (ICMTS) should be strengthened, codified and placed under the oversight of the National Ocean Council. And because marine transportation involves many actors outside the Federal Government, the Marine Transportation System National Advisory Council should be maintained to coordinate among non-Federal participants in the marine transportation system and a venue for providing input to the Federal Government on important national issues.

An important step in allowing the U.S. marine transportation system to grow, while minimizing increased congestion, delays, and costs to U.S. businesses and consumers, is to improve the movement of cargo into and out of ports. Existing intermodal connections are inadequate to meet the expected increase in foreign and domestic trade. The nation's transportation infrastructure is largely an agglomeration of competing transportation modes, each focusing on its own priorities. While this approach has produced an extensive infrastructure, a national strategy is needed to enhance the connections among these modes, including the nation's ports, and ensure greater overall effectiveness.

DOT, working with the ICMTS, should draft a new national freight transportation strategy to support continued growth of the nation's economy and international and domestic trade. Based on the new strategy, investments should be directed toward planning and implementation of intermodal projects of national significance. In developing the national freight transportation strategy, DOT should emphasize strategic planning with States, regions, and the public sector as is already being carried out for the U.S. highway system.

Planning for the future of the U.S. marine transportation system requires accurate and timely information, including estimates of the volume of current and future cargo transportation, their origins and destinations, and the capacity of the various transportation modes. Such information is essential to understand the strengths and weaknesses of the current system and the challenges and opportunities for improving its effectiveness. DOT, working with other appropriate entities, should establish a national data collection, research, and analysis program to provide a comprehensive picture of freight flows in the United States and to enhance the performance of the nation's intermodal transportation system. DOT should periodically assess and prioritize the nation's future needs for ports and intermodal transportation capacity to meet expected growth in marine commerce.

Finally, natural disasters, labor disputes, terrorist attacks, ship collisions, spills of hazardous materials, and many other human and naturally caused events can disrupt the flow of marine cargo and passenger services, causing severe economic and social ramifications nationally and internationally. Diminished port capacity could also affect vital military operations. In developing a national freight transportation strategy, DOT should work closely with the U.S. Department of Homeland Security and the FEMA to incorporate port security and other emergency preparedness requirements. The strategy should focus on preventing threats to national security and port operations and on response and recovery practices that limit the impacts of such events, including an assessment of the availability of alternative port capacity.

COASTAL AND OCEAN WATER QUALITY

Coastal and ocean water quality is threatened by multiple sources of pollution, including point and nonpoint source pollution, atmospheric deposition of pollutants, vessel pollution, invasive species, and trash being washed into the ocean and onto beaches. Addressing these multiple pollutants will require development of an ecosystem-based and watershed management approach that includes a variety of management tools, coordination, and ongoing monitoring.

Addressing Coastal Water Pollution

Coastal waters are one of the nation's greatest assets, yet they are being bombarded with pollution from all directions. The heavy concentration of activity in coastal areas, combined with pollutants flowing from streams far inland and others carried through the air great distances from their source, are the primary causes of nutrient enrichment, hypoxia, toxic contamination, sedimentation, and other problems that plague coastal waters.

Any solution must be founded on an ecosystem-based and watershed management approach involving a broad range of agencies, programs, and individuals. The complex array of laws, agencies, and programs that address water pollution, and the number of parties involved, will require greatly enhanced coordination among Federal agencies, primarily EPA, NOAA, USDA, and USACE. Greater coordination is also needed between the Federal Government and managers at the State, territorial, tribal, and local levels, watershed groups, nongovernmental organizations, private stakeholders, and the academic and research communities. Solutions will also require a substantial financial investment and will take time.

Reducing Point Sources of Pollution

Over the last few decades, great strides have been made in controlling water pollution from point sources, although further improvements could be realized through increased funding, strengthened enforcement, and promotion of innovative ap-

proaches such as market-based incentives. The Commission also addresses several specific point sources of pollution, including wastewater treatment plants, sewer system overflows, septic systems, industrial facilities, and animal feeding operations.

Increasing the Focus on Nonpoint Sources of Pollution

While considerable progress has been made in reducing point sources of pollution, further progress toward improving coastal water quality will require significant reductions in nonpoint sources as well. This pollution occurs when rainfall and snowmelt carry pollutants over land, into streams and groundwater, and down to coastal waters. Ninety percent of impaired water bodies do not meet water quality standards at least in part because of nonpoint source pollution. The majority of the nonpoint source pollution entering rivers, estuaries, coastal waters, and ultimately the oceans is from agricultural and stormwater runoff.

To address nonpoint source pollution, the NOC should establish significant reduction of nonpoint source pollution in all impaired coastal watersheds as a national goal, and set measurable objectives to meet water quality standards. The nation has a number of opportunities to reduce the impacts of nonpoint sources of pollution on coastal waters. Because agricultural runoff contributes substantially to nonpoint source pollution, USDA should align its conservation programs and funding with other programs aimed at reducing nonpoint source pollution, such as those of EPA and NOAA. Other opportunities for the nation to reduce nonpoint source pollution include coordination of Federal nonpoint programs so they are mutually supportive, more targeted and aggressive use of state revolving loan funds, broader implementation of incentives and disincentives, and improved monitoring to assess compliance and overall progress. State and local governments also have important roles to play in land use planning and stormwater management decisions.

Watersheds are often the appropriate geographic unit for addressing water-related problems and collaborative watershed groups have had significant successes in addressing nonpoint source pollution. Therefore, the NOC and regional ocean councils should strengthen the ability of collaborative watershed groups to address problems associated with nonpoint source pollution by developing and implementing strategies to provide them with adequate technical, institutional, and financial support.

Addressing Atmospheric Sources of Pollution

Atmospheric deposition of pollutants can also harm water quality, aquatic resources, and human health. To address atmospheric deposition, EPA, States, and watershed groups should explore regional approaches for managing atmospheric deposition, particularly when it affects water bodies in states far from the source.

Creating a National Water Quality Monitoring Network

Pollution of the nation's coastal waters has led to beach closures, oxygen depletion, health impacts from toxic contamination, and many other problems. Despite these threats to coastal waters, there is no national network in place to monitor water quality changes and their causes, facilitate estimates of their economic impact, and measure the success of management efforts. Increased monitoring is needed not only along the nation's coasts, but also inland where pollutants make their way downstream, ultimately impacting coastal waters. A national water quality monitoring network is essential to support the move toward an ecosystem-based management approach that considers human activities, their benefits, and their potential impacts within the context of the broader biological and physical environment. An essential step toward controlling pollution will be to strengthen and coordinate monitoring efforts to provide decision makers with necessary information.

A number of monitoring efforts are currently conducted by Federal agencies, State governments, research institutions and academia, nongovernmental organizations, and individual volunteers. Existing monitoring programs vary in many respects, including sampling design and intensity, parameters tested, analytical methodology, data management protocols, and funding. Even when the same properties are measured, different data management protocols may make the integration of that information difficult. Consequently, while a number of monitoring programs exist, they are not designed to support a comprehensive and coordinated national monitoring network.

Ensuring Comprehensive, Coordinated Coverage

The nation's coastal margin is the most densely populated and developed region of the nation, and its waters have been significantly degraded by pollution. Yet in recent years, due largely to lack of funding, monitoring has been extremely sparse along the coasts. Much remains unknown about the status of coastal waters, and increased monitoring will be required to make informed management decisions

about this economically and ecologically valuable region. Yet the close connections between coastal and upstream waters dictate that any water quality monitoring network must be national in scope. NOAA, EPA, and USGS should lead the effort to develop a national water quality monitoring network that coordinates existing and planned monitoring efforts, including Federal, State, local, and private efforts. The network should include a federally-funded backbone of critical stations and measurements needed to assess long-term water quality trends and conditions.

Because of the inherent overlap between inland, coastal, and open-ocean monitoring and observing, the national water quality monitoring network should be closely linked with the Integrated Ocean Observing System (IOOS) and ultimately with a broad Earth observing system. NOAA should ensure that the water quality monitoring network includes adequate coverage in both coastal areas and the upland areas that affect them, and that the network is linked to the IOOS, to be incorporated eventually into a comprehensive Earth observing system.

Creating an Effective Monitoring Network and Making Data Accessible and Useful

In addition to coordinating existing monitoring efforts, an effective national water quality monitoring network should have specific goals and objectives, reflect user needs, and be helpful in assessing the effectiveness of management approaches. The overall system design should determine what and where to monitor, including definition of a set of core variables. Technical expertise will be needed to standardize procedures and establish quality control and data management protocols. The network should be periodically assessed and modified as necessary. Most important, the data collected through the national monitoring network should be useful to managers and stakeholders in evaluating management measures, determining best management practices, and making continual improvements in reaching ecosystem goals. This data should also be translated into timely and useful information products that are readily accessible to decision makers and the public. The design and implementation of the national monitoring network will require not only Federal coordination, but also significant input from the States.

Limiting Vessel Pollution and Improving Vessel Safety

The benefits from vessel activities are significant—ships carry more than 95 percent of the nation's overseas cargo—but these operations also present safety, security and environmental risks that must be effectively addressed.

Success in addressing these concerns will depend on a broad domestic and international framework comprised of three key components. The first component is a strong voluntary commitment on the part of vessel owners and operators to build a workplace ethic that incorporates safety, security, and environmental protection as important and valued aspects of everyday vessel operations. Reliable means of measuring the success of these efforts, as reflected in crew and company performance, are essential and should include extensive use of third-party audits. The U.S. Coast Guard, through incentives and partnership programs, should encourage industry partners to develop stronger voluntary measures, particularly those that reward crew member contributions, as part of a continuing long-term effort that focuses on building a culture of safety, security, and environmental compliance.

The second key component is effective oversight and control by the primary vessel regulator, the vessel's flag state. Foreign flag vessels, subject primarily to the jurisdiction and control of other governments, carry more than 90 percent of international commercial freight entering and departing the United States and account for 95 percent of passenger ships and 75 percent of cargo ships operating in U.S. waters. Although many flag states take their responsibilities seriously, oversight and enforcement vary dramatically. Over the past decade, the International Maritime Organization has developed guidelines to improve flag state oversight and enforcement. However, implementation of these measures has met with mixed results. Mounting international security concerns have made effective flag state oversight and control more urgent today than ever before. The United States should work with other nations to accelerate efforts at the International Maritime Organization to enhance flag state oversight and enforcement. Initiatives should include expeditious promulgation of a code outlining flag state responsibilities, and development of a mandatory external audit regime to evaluate performance and identify areas where additional technical assistance can be used to best advantage.

The third key framework component is effective control over vessels visiting U.S. ports. The Coast Guard currently carries out a port state control program that allocates limited inspection resources to the highest-risk vessels, based on an assessment of the vessel owner, flag state, classification society, performance history, and vessel type. Performance-based vessel inspections, while the most effective means of

verifying compliance, are resource intensive. These inspections have played a critical role in identifying and correcting potential problems, and in assessing the effectiveness of overall efforts to improve safety and environmental compliance. Concerns have been expressed in Congress and elsewhere about the adequacy of Coast Guard resources to meet new security demands while fulfilling other important responsibilities. Congress should provide the U.S. Coast Guard with the resources necessary to sustain and strengthen the performance-based inspection program for marine safety and environmental protection while also meeting new vessel security inspection and other maritime security requirements. In addition, the Coast Guard should work at the regional and international levels to increase effective coordination and vessel information sharing among concerned port states.

In addition to outlining a framework to address vessel safety, security and environmental concerns, our report also recommends more comprehensive approaches to address waste stream, oil and air pollution from commercial and recreational vessels. Recommendations include: establishing a uniform national regime to deal with cruise ship waste streams; ratifying and working to strengthen MARPOL Annex V1 air emission standards; developing comprehensive policy guidance and contingency plans for vessels seeking places of refuge in the United States; developing a long-term plan that identifies and addresses the greatest risks associated with marine oil transportation systems; and updating and accelerating efforts to reduce recreational vessel pollution. We also place particular emphasis on the use of market-based mechanisms and incentives to reduce pollution and encourage appropriate voluntary actions.

Preventing the Spread of Invasive Species

The introduction of non-native marine organisms into ports, coastal areas, and watersheds has damaged marine ecosystems around the world, costing millions of dollars in remediation, monitoring, and ecosystem damage. Invasive species policies are not keeping pace with the problem primarily because of inadequate funding, a lack of coordination among Federal agencies, redundant programs, and outdated technologies.

Making Prevention the First Line of Defense

The discharge of ballast water is considered a primary pathway for introduction of non-native aquatic species. Exchanging ballast water in the middle of the ocean to reduce the risk of transferring organisms from one ecosystem to another is the primary management tool currently available for ships to control the introduction of invasive species.

To better control the introduction of invasive species, the U.S. Coast Guard's national ballast water management program should: apply uniform, mandatory national standards; incorporate sound science in the development of a biologically meaningful and enforceable ballast water treatment standard; include a process for revising the standard to incorporate new technologies; ensure full consultation with EPA; and include an interagency review, through the NOC, of the policy for ships that declare they have no ballast on board.

While ballast water is considered a primary pathway, there are also other important ship-related sources of non-native aquatic species, including ships' hulls, anchors, navigational buoys, drilling platforms, and floating marine debris. Other pathways include intentional and unintentional human introductions of fish and shellfish, and illegally released organisms from the aquaculture, aquarium, horticulture, and pet industries. There is increasing concern that an expanding trade through the Internet and dealers of exotic pets is exacerbating the invasive species problem.

To address these pathways of introduction, the NOC, working with the Aquatic Nuisance Species Task Force and the National Invasive Species Council, should coordinate public education and outreach efforts on aquatic invasive species, with the aim of increasing public awareness about the importance of prevention.

Accelerating Detection and Response

Only the most draconian prevention strategy could hope to eliminate all introductions of non-native species and thus prevent the possibility of an invasion. Yet no effective mechanism is in place for rapidly responding to newly discovered aquatic invasions when they do occur. Therefore, the National Invasive Species Council and the Aquatic Nuisance Species Task Force, working with other appropriate entities, should establish a national plan for early detection of invasive species and a system for prompt notification and rapid response.

Improving the Control of Invasive Species

As biological invasions continue, there is a pressing need to improve the control of invasive species by reducing the overlaps and redundancies caused by the involvement of so many agencies with insufficient interagency coordination. The NOC should review and streamline the current proliferation of Federal and regional programs for managing marine invasive species, and coordinate Federal, regional and State efforts.

The study of marine biological invasions is a relatively new research area and little is understood about how or why certain species become invasive, what pathways of introduction are most important, and whether certain factors make an ecosystem more susceptible to invasions. To better understand marine biological invasions, the NOC should coordinate the development and implementation of an interagency plan for research and monitoring to understand and prevent aquatic species invasions.

Reducing Marine Debris

The trash and other waste that drifts around the global ocean and washes up on the nation's shores poses a serious threat to fishery resources, wildlife, and habitat, as well as human health and safety. Approximately 80 percent of debris is washed off the land, blown by winds, or intentionally dumped from shore, while 20 percent comes from vessels and offshore platforms.

NOAA currently addresses marine debris as a part of several other efforts, but there is a need to coordinate, strengthen, and increase the visibility of the marine debris efforts within NOAA by creating a centralized marine debris program within the agency. This program should be coordinated with EPA's marine debris activities, as well as with the significant efforts conducted by private citizens, state, local, and nongovernmental organizations.

Interagency Coordination

Although strengthening NOAA's work on marine debris through establishment of an office within the agency is an important step, an interagency committee under the NOC is needed to unite all appropriate Federal agencies around the issue. Such a committee could support existing marine debris efforts by agencies and nongovernmental organizations, and should expand and better coordinate national and international marine debris efforts, including: public outreach and education; partnerships with state and local governments, community groups, nongovernmental organizations, and industry; and monitoring, identification and research.

Eliminating Derelict Fishing Gear

Whether intentionally discarded or unintentionally lost during storms or fishing operations, derelict fishing gear poses serious threats, entrapping marine life, destroying coral reefs and other habitat, and even posing danger to humans. Although derelict fishing gear is a worldwide problem, currently no international treaties or plans of action address it. A strong need exists for the U.S. Department of State and NOAA, working with the United Nations Food and Agriculture Organization, to develop a plan of action to address derelict fishing gear, to be implemented on a regional, multi-national basis. In addition, within the United States, a public-private partnership program is needed to prevent, remove, and dispose of derelict fishing gear.

Ensuring Appropriate Port Reception Facilities

Under requirements for port reception facilities in Annex V of MARPOL, member nations must provide waste disposal facilities in their ports to receive waste from ships. Despite this requirement, many ports do not have adequate facilities. In addition, Annex V calls for the designation of Special Areas that receive a higher level of protection than is required in other ocean areas. Special Areas have been designated for many parts of the world, however, for a Special Area to receive extra protection, there must first be a demonstration of adequate port reception facilities. Some important Special Areas, such as the Wider Caribbean, are not yet eligible to receive extra protection because of inadequate port reception facilities. Therefore, the U.S. Department of State should increase efforts to ensure that all port reception facilities meet the criteria necessary to allow implementation of Special Areas protections.

ENHANCING THE USE AND PROTECTION OF OCEAN RESOURCES

The ocean's biological and mineral resources are of enormous value to the nation, not only for their direct economic output, but also for their incalculable aesthetic importance.

The commercial fishing industry's total value exceeds $28 billion annually, with the recreational saltwater fishing industry valued at around $20 billion. NOAA estimates that U.S. coral reefs cover approximately 7,600 square miles. In 2001, coral reefs in the Florida Keys alone supported $105 million in income and more than 8,000 jobs. Further, approximately one-half of all federally managed commercial fish species depend on coral reefs for at least part of their life cycle. Currently, energy development in Federal waters accounts for more than 30 percent of domestic oil production and 25 percent of natural gas, with a total annual value of between $25–$40 billion, and a contribution of about $5 billion in royalties to the U.S. Treasury.

In order to provide for sustainable use, management needs to be strengthened in a broader context that looks at impacts of management decisions on the ecosystem as a whole.

Fisheries Management

The last 30 years has seen the evolution of an industry from being largely unregulated but with seemingly boundless potential, to one that is highly regulated and struggling to regain its potential as we move toward a sustainable, ecosystem-based fisheries management regime.

In 1976, based in part on the recommendations of the Stratton Commission, Congress approved the Magnuson-Stevens Fishery Conservation and Management Act to manage and assert U.S. control over fishery resources within 200 nautical miles of the coast. Eight Regional Fishery Management Councils (RFMCs) were created to develop management plans for fisheries in Federal waters. The Act required regional plans to be consistent with broad national guidelines, but otherwise granted considerable flexibility to the RFMCs. The regional flexibility that had been seen as a great strength of the new law now showed its downside as some RFMCs set unsustainable harvest levels, leading to the collapse or near-collapse of several important fisheries.

In the over 30 years since the Stratton report, some fishery management bodies have revealed fundamental weaknesses in the system that led to overexploited stocks and ecosystem degradation in some regions. However, the management practices in some regions, particularly the North Pacific, protected fisheries from over exploitation and served as a model for many of the Commission's fisheries recommendations. The Commission fishery recommendations can be grouped into six areas: strengthening the link between science and management, clarifying jurisdiction representation, expanding the use of dedicated access privileges, improving enforcement, and strengthening international management.

The link between fishery management decisions and peer-reviewed scientific info must be strengthened, including developing an expanded research program that is more responsive to managers' needs. To accomplish this, a number of management improvements are needed. RFMCs should be required to rely on the advice of their Scientific and Statistical Committees (SSCs), especially when setting harvest levels. RFMCs should not be allowed to approve measures less conservative than recommended by the SSC. SSC members should be nominated by the RFMCs and appointed by the NOAA Administrator. To ensure that SSC members are of the highest quality, their credentials and potential conflicts of interest should be reviewed by an external organization. To ensure sufficient external review of the scientific advice of the SSCs, NOAA should develop a standardized, independent peer-review process for implementation by all RFMCs. To ensure that needed conservation measures are implemented in a timely manner, default measures should be developed that would go into effect with a lack of action on the part of the RFMCs. Finally, to ensure that manager's have the information they require, NOAA's process for developing research plans should incorporate manager's priorities to the extent practicable. An expanded cooperative research program and increased emphasis on in-season recreational fishery data collection should be an important component of this effort.

Responsibilities and jurisdiction of the various Federal and interstate fishery management entities need to be clarified, and the representation on the Federal regional fishery management councils need to be broadened. To ensure that jurisdictional confusion does not lead to delaying conservation measures, Congress should assign a lead management authority among the various Federal and interstate management authorities, based primarily on proportion of catch occurring within each entities jurisdiction. To ensure that the RFMCs have appropriate representation, particularly as we move toward ecosystem-based management, the governors should be required to submit a broader slate of candidates to be appointed by the NOAA Administrator. To ensure that RFMCs members have the necessary knowledge to properly manage fisheries, members should be required to take a training course. Finally, to ensure that all interstate fishery commissions have the necessary means

to manage the fisheries under their jurisdiction, Congress should grant authority similar to the Atlantic Coastal Fisheries Cooperative Management Act to the Gulf and Pacific States Commissions.

To reverse existing incentives that create an unsustainable "race for the fish," fishery managers should explore widespread adoption of dedicated access privileges to promote conservation and help reduce overcapitalization. Congress should amend the Magnuson-Stevens Fishery Conservation and Management Act to affirm that fishery managers are authorized to institute dedicated access privileges, subject to meeting national guidelines; and every Federal, interstate, and State fishery management entity should consider the potential benefits of adopting dedicated access programs. In addition, Congress should directly address overcapitalization by revising Federal programs that subsidize overcapitalization, as well as work with NOAA to develop programs that permanently address overcapitalization in fisheries.

Fishery enforcement must be improved through adoption of better technology, such as Vessel Monitoring Systems (VMS) and better cooperation among Federal agencies and States. Funding should be increased for Joint Enforcement Agreements between NOAA's National Marine Fisheries Service and coastal states as the best method of restoring the enforcement presence of the Coast Guard diminished because of the increased need for maritime security following the 9/11 terrorist attacks. The expanded use of VMS is another cost effective way of increasing enforcement capabilities.

Fishery management needs to continue the move toward ecosystem-based management in order to improve management, reduce conflicts between socio-economic impacts and biological sustainability, and provide a proper forum to address difficult management issues. In particular, issues such as habitat damage and bycatch should be approached from an ecosystem basis and management plans should be designed to reduce impacts from these factors.

Because many of the stocks targeted by U.S. fishermen traverse international waters, it will be impossible to conserve some stocks without the aid of other countries. In addition, many endangered species such as sea turtles and whales travel the high seas. To promote international cooperation to conserve living marine resources, the Commission makes the following recommendations. The United States should work to encourage other countries to adopt and enforce existing international agreements to promote worldwide adoption of sustainable fisheries practices, in particular the Fish Stocks Agreement and the United Nations Food and Agriculture Organization's Compliance Agreement. The National Ocean Council should recommend effective methods to promote adoption of other important international conservation agreements, such as the Code of Conduct for responsible fisheries. In addition, the United States should continue to press for the inclusion of environmental objectives—particularly those specified in international environmental agreements—as legitimate elements of trade policy.

Marine Mammals and Endangered Species

Because of their intelligence, visibility and frequent interactions with humans, marine mammals hold a special place in the minds of most people and are afforded a higher level of protection than fish or other marine organisms. The American public has also consistently been supportive of efforts to prevent species from becoming endangered or extinct from human-caused activities. Because of the concern that the American public has shown for marine mammals and endangered species, specific legislation was enacted to provide them greater protection. The Marine Mammal Protection Act and the Endangered Species Act are landmark laws that have protected marine mammals and populations in danger of extinction since their passage. However, both Acts need to move toward a more ecosystem-based regime to improve protections for these populations.

The biggest threat to marine mammals worldwide today is their accidental capture or entanglement in fishing gear (known as "bycatch"), killing hundreds of thousands of animals a year. Commercial harvesting contributed to major declines in the populations of marine mammals but only a few nations still allow hunting for purposes other than subsistence. Hunters from those nations continue to kill hundreds of thousands of seals, whales, dolphins, and other marine mammals each year while legal subsistence hunting accounts for thousands more. Other potential causes of death and injury to marine mammals, such as ships strikes, pollution and toxic substances, and noise from ships and sonar, cause many fewer deaths than bycatch and hunting.

The threats to endangered marine species such as sea turtles and sea birds are myriad and not easily categorized. One factor that is common to declines in many species is the destruction or degradation of their natural habitat. Thus the success-

ful recovery of a species depends to a large degree on protection or restoration of this habitat.

One of the critical components to improving protections for protected species is expanding the knowledge base. We know very little about the basic biology for these species, particularly marine mammals. The lack of basic scientific information has perhaps contributed to the frequent mismatch between causes of impacts to marine mammal populations and the amount of management attention paid to them. For example, the top two impacts to marine mammals by orders of magnitude are bycatch and hunting, yet most recent attention is being paid to other causes. Under ecosystem-based management, the most critical impacts should be addressed first. However, our overwhelming lack of knowledge of marine mammal and endangered species makes it difficult to properly rank and address impacts to these species. As the foundation to improving management, the Commission recommends an expanded research, technology, and engineering program, coordinated through the National Ocean Council, to examine and mitigate the effects of human activities on marine mammals and endangered species. In particular, Congress should expand Federal funding for research into ocean acoustics and the potential impacts of noise on marine mammals. The United States should increase efforts to extend the benefits of the expanded research program to other countries.

Another important component to improving protections for protected species will be to clarify and coordinate Federal agency actions. The Commission recommends that jurisdiction for marine mammals be consolidated within NOAA, and that the NOC improve coordination between NOAA and the Fish and Wildlife Service with respect to the implementation of the Endangered Species Act, particularly for anadromous species or when land-based activities have significant impacts on marine species.

The MMPA, with limited exceptions, prohibits the hunting, killing, or harassment of marine mammals. One of the exceptions authorizes the issuance of permits for the unintentional and incidental taking of small numbers of marine mammals provided it has only a negligible impact on the species. This provision has been problematic because terms such as small numbers and negligible impact are not defined in the Act, resulting in a lack of clarity about when a permit is necessary and under what circumstances it should be granted. Congress should amend the Marine Mammal Protection Act to require the NOAA to more clearly specify categories of activities that are allowed without a permit, those that require a permit, and those that are prohibited. Specifically, Congress should amend the Marine Mammal Protection Act to revise the definition of harassment to cover only activities that meaningfully disrupt behaviors that are significant to the survival and reproduction of marine mammals.

As an adjunct to clarifying allowed and permitted activities, the permitting process itself should be streamlined. Specifically, programmatic permitting should be used where possible to simplify agency permitting.

Coral Communities

Tropical and deepwater coral communities are among the oldest and most diverse ecosystems, rivaling tropical rainforests in biodiversity and economic value. But, tropical coral reef health is rapidly declining, with pristine reefs being rare or nonexistent and possibly one-third of the world's reefs severely damaged. The existing management structure is inadequate and agencies and laws overseeing coral reef management have made little progress in actually protecting corals. Immediate action is needed to avoid irreversible harm.

In the short-term, the Coral Reef Task Force (CRTF) should be strengthened by placing it under the NOC, and adding the U.S. Department of Energy and the U.S. Army Corps of Engineers. The strengthened CRTF should begin immediate development of actions to reverse impacts of coastal pollution and fishing on coral communities. The EPA and USDA, at the minimum, should be charged with implementing the coastal pollution reduction plan and NOAA should be charged with implementing the plan for reversing impacts from fishing. In addition, the CRTF's area of responsibility should be expanded to include deepwater coral communities as well.

In the long-term, the Congress should enact a "Coral Protection and Management Act" that provides direct authority to protect and manage corals, and provides a framework for research and cooperation with international protections efforts. This legislation should include the following elements: support for mapping, monitoring, and research programs; support for new research and assessment activities to fill critical information gaps; liability provisions for damages to coral reefs similar to those in the Marine Protection, Research, and Sanctuaries Act; support for outreach activities to educate the public about coral conservation and reduce human impacts;

and, support for U.S. involvement, particularly through the sharing of scientific and management expertise, in bilateral, regional, and international coral reef management programs.

As the world's largest importer of ornamental coral reef resources, the United States has a particular responsibility to help eliminate destructive harvesting practices and ensure the sustainable use of these resources. Many of these resources are harvested by methods that destroy reefs and overexploit ornamental species. A balance is needed between sustaining the legitimate trade in ornamental resources and sustaining the health and survival of the world's coral reef resources. The United States should develop domestic standards for the importation of coral species, to ensure that U.S. citizens do not indirectly promote unsustainable practices in coral harvesting countries.

Aquaculture

Marine aquaculture has the potential to supply part of the ever increasing domestic and worldwide demand for seafood. However, there are two major concerns that need to be addressed: environmental problems with existing aquaculture operations, particularly net-pen facilities, and a confusing, inconsistent array of State and Federal regulations that hinder private sector investment.

To oversee a comprehensive and environmentally sound management regime, Congress should amend the National Aquaculture Act to designate NOAA as the lead Federal agency for implementing a national policy for environmentally and economically sustainable marine aquaculture and create an Office of Sustainable Marine Aquaculture in NOAA.

This new NOAA office should develop a single, multi-agency Federal permit for the aquaculture industry and ensure aquaculture facilities meet State and national environmental standards to lessen impacts from escapement and disease and protect the sustainability and diversity of wild stocks.

Furthermore, the permitting and leasing system and implementing regulations should: reflect a balance between economic and environmental objectives consistent with national and regional goals; be coordinated with guidelines and regulations developed at the State level; include a system for the assessment and collection of a reasonable portion of the resource rent generated from marine aquaculture projects that use ocean resources held in public trust; require applicants to post a bond to ensure that any later performance problems will be remedied and that abandoned facilities will be safely removed at no additional cost to the taxpayers; and, require the development, dissemination, and adoption by industry of best management practices that are adaptable to new research and technology advances.

Enhanced investments in research, demonstration projects, and technical assistance can help the industry address environmental issues, conduct risk assessments, develop technology, select species, and improve best management practices. It is also vital for developing fair and reasonable policies, regulations, and management measures. Most of the Federal research to support marine aquaculture has been carried out under the auspices of NOAA's National Sea Grant College Program, which funds primarily university-based research. Congress should increase funding for expanded marine aquaculture research, development, training, extension, and technology transfer programs in NOAA. The Office of Sustainable Marine Aquaculture should set priorities for the research and technology programs, in close collaboration with academic, business, and other stakeholders.

Because the U.S. market for seafood is one of the largest in the world, we can use our market power as a positive force for promoting sustainable, environmentally sound aquaculture practices not only in the United States, but the world as well. The United States should work to ensure that all countries adhere to aquaculture standards such as are in the UN FAO Code of Conduct for Responsible Fisheries.

Oceans and Human Health

Beneficial and harmful links between human health and ocean health exist. While several important medical treatments are based on chemicals discovered in marine animals, increasingly common phenomena such as harmful algal blooms have demonstrated ability to negatively impact human health. The health of marine ecosystems is affected by human activities such as pollution, global warming, and fishing. But in addition, human health depends on thriving ocean ecosystems. A better understanding about the many ways marine organisms affect human health, both for good by providing drugs and bioproducts, and for bad by causing human ailments, is needed.

Congress should establish an oceans and human health initiative to create a competitive grant program and coordinate Federal activities. Existing programs at NOAA, NSF and the National Institute of Environmental Health Sciences should

be coalesced in this initiative. This initiative should be expanded to include other pertinent agencies such as the EPA and FDA.

New knowledge and technologies are needed to detect and mitigate microbial pathogens. These methods must be quick and accurate so that information can be communicated to resource managers and the coastal community in a timely manner. As they are developed, technologies need to be integrated into biological and biochemical sensors that can continuously monitor high-risk sites. It is important that site-specific sensor data and satellite sensor data be incorporated into the IOOS. To accomplish this task, the National Oceanic and Atmospheric Administration, National Science Foundation, National Institute of Environmental Health Sciences, and other appropriate entities should support the development and implementation of improved methods for monitoring and identifying pathogens and chemical toxins in ocean waters and organisms.

Offshore Energy and Mineral Resources

Oil and gas development on the Outer Continental Shelf (OCS) provides over a quarter of our domestic oil and gas reserves, and contributes thousands of jobs and billions of dollars to our economy. In addition to its responsibilities for living marine resources, the Federal Government also exercises jurisdiction over nonliving resources, energy and other minerals located in the waters and seabed of the more than 1.7 billion acres of OCS. Offshore oil and gas development has the most mature and broadest management structure of all such resources. Although controversial in many areas, the process for oil and gas leasing and production is well institutionalized, reasonably comprehensive, and could be a model for new ocean-based renewable energy projects as part of a coordinated offshore management regime.

MMS's Environmental Studies Program (ESP) is a major source of information about the impacts of OCS oil and gas activities on the human, marine, and coastal environments. Since 1986, annual funding for the program has decreased, in real dollars, from a high of $56 million to approximately $18 million in 2003. The erosion in ESP funding has occurred at a time when more and better information, not less, is needed. There continues to be a need to better understand the cumulative and long-term impacts of OCS oil and gas development, especially in the area of low levels of persistent organic and inorganic chemicals, and their cumulative or synergistic effects.

The U.S. Department of the Interior should reverse recent budgetary trends and increase funding for the Minerals Management Service's Environmental Studies Program. The development of technologies and exploratory activities moving into very deep waters requires an increase in the MMS environmental studies program to keep track of new and emerging environmental issues. In addition to this program, the development of the IOOS could provide better information that can improve management of offshore resources. Industry and Federal agency partnerships should allow use of industry facilities to be incorporated into the IOOS.

To make certain that the Federal-State partnership is strengthened and that critical marine ecosystems are protected, more investment of the resource rents generated from OCS energy leasing and production into the sustainability of ocean and coastal resources is necessary. Specifically, some portion of the revenues received by the Federal Government annually for the leasing and extraction of nonrenewable offshore resources need to be allocated to all coastal states for programs and efforts to enhance the conservation and sustainable development of renewable ocean and coastal resources. Congress should ensure that revenues received from leasing and extraction of oil and gas and other new offshore uses are used to promote sustainable development of renewable ocean and coastal resources through creation of a grant program to all coastal states, with a larger share going to OCS producing States.

Conventional oil and gas are not the only fossil-based fuel sources located beneath ocean floors. Methane hydrates are solid, ice-like structures composed of water and natural gas. They occur naturally in areas of the world where methane and water can combine at appropriate conditions of temperature and pressure, such as in thick sediments of deep ocean basins, at water depths greater than 500 meters. The estimated amount of natural gas in the gas hydrate accumulations of the world greatly exceeds the volume of all known conventional gas resources. Conservative estimates reveal the quantity is enough to supply all of the nation's energy needs for more than 2,000 years at current rates of use. However, there is still no known practical and safe way to develop the gas and it is clear that much more information is needed to determine if methane hydrates can become a commercially viable and environmentally acceptable source of energy. The National Ocean Council (NOC), working with the U.S. Department of Energy and other appropriate entities, should determine whether methane hydrates can contribute significantly to meeting the nation's

long-term energy needs. If such contribution looks promising, the NOC should determine how much the current investment in research and development efforts should be increased.

There is continued interest in offshore renewable technologies as a means of reducing U.S. reliance on potentially unstable supplies of foreign oil, diversifying the nation's energy mix, and providing more environmentally benign sources of energy. As long as Federal agencies are forced to bootstrap their authorities to address these activities, the nation runs the risk of unresolved conflicts, unnecessary delays, and uncertain procedures. What is urgently needed is a comprehensive offshore management regime, developed by the National Ocean Council, which is designed to review all offshore uses in a greater planning context. A coherent and predictable federal management process for offshore renewable resources that is able to weigh the benefits to the nation's energy future against the potential adverse effects on other ocean users, marine life, and the ocean's natural processes, should be fully integrated into the broader management regime. Congress, with input from the National Ocean Council, should enact legislation providing for the comprehensive management of offshore renewable energy development as part of a coordinated offshore management regime. Specifically, this legislation should: streamline the process for licensing, leasing, and permitting renewable energy facilities in U.S. waters; subsume existing statutes, such as the Ocean Thermal Energy Conversion Act, and should be based on the premise that the oceans are a public resource; and, ensure that the public receives a fair return from the use of that resource and development rights are allocated through an open, transparent process that takes into account State, local, and public concerns.

ADVANCING INTERNATIONAL OCEAN SCIENCE AND POLICY

The United States has traditionally been a leader in international ocean policymaking and has participated in the development of many international agreements that govern the world's ocean areas and resources. That leadership must be maintained and reinvigorated. The international ocean challenges of the 21st century will require improved collaboration among domestic and international policymakers to establish ambitious objectives and take the actions necessary to achieve them.

The United States can best advance its own ocean interests and positively contribute to the health of the world's oceans by first ensuring that U.S. domestic policies and actions embody exemplary standards of wise, sustainable ocean management. The new national ocean policy framework will be instrumental in setting this positive tone for the international ocean community. The Commission also recommends several specific actions to maintain and reinvigorate the leadership of United States in global ocean issues:

U.S. Accession to the United Nations Convention on the Law of the Sea

The United States should accede to the United Nations Convention on the Law of the Sea—the preeminent legal framework for addressing international ocean issues. Until that step is taken, the nation will not be able to fully participate in bodies established under the Convention that make decisions on issues of importance to all coastal and seafaring nations, or to assume its important leadership role and protect United States interests as the law of the sea evolves.

Enhanced Coordination Among U.S. Ocean-Related Federal Agencies

Within the U.S. Government, the U.S. Department of State is the lead agency for most ocean-related international negotiations. However, the role of more specialized agencies is extremely important due to the science and resource focus of many multilateral ocean issues. Consistent involvement of a wide range of experts is essential both to establish international standards that reflect U.S. interests, and to ensure that subsequent actions by the United States and others are in accordance with those standards.

A new mechanism is needed to provide the optimum degree of coordination among U.S. agencies sharing responsibility and knowledge of international ocean issues. An interagency committee should be established under the auspices of the National Ocean Council to enhance coordination and collaboration among U.S. Government agencies, strengthening U.S performance at international negotiations and improving implementation of international ocean policy.

Successful national and international ocean policy depends on sound scientific information. It is essential, therefore, to ensure that U.S. policymakers benefit from timely advice and guidance from the U.S. marine scientific community. This, in turn, requires procedures that both give scientists the opportunity to provide input and policy makers the chance to carefully consider their recommendations. The State Department should increase its internal training and scientific support to en-

sure better integration of ocean-related scientific expertise in policy and program development and implementation. In addition, the Department should develop more effective mechanisms to facilitate input from other government agencies and the broader scientific community.

Building International Capacity in Ocean Science and Management

Implementation of international ocean policy and improved management of ocean and coastal resources worldwide are affected by the adequacy of the science and management capacity of every coastal nation. To maintain progress on a global scale, the United States and other capable nations must assist coastal nations of more limited means. To be most effective, assistance should be science-based and developed within the context of an ecosystem-based approach. The U.S. Department of State should offer strong support for U.S. scientists conducting research programs around the world. Existing international partnerships should be strengthened and new partnerships promoted to facilitate the conduct of international research.

Capacity-building efforts should be concentrated on issues that have been identified as particularly critical for the health of an ecosystem or marine species, and have the greatest potential for positive impacts. In most instances, effective capacity-building will require long-term efforts to change detrimental practices and build support for new, sustainable management approaches. These efforts will require a funding commitment sufficient to make the changes needed to preserve or rebuild healthy ecosystems. As part of its international leadership role, the United States should increase its efforts to enhance long-term ocean science and management capacity in other nations through funding, education and training, technical assistance, and sharing best practices, management techniques, and lessons learned.

IMPLEMENTING A NEW NATIONAL OCEAN POLICY

To implement the blueprint for a new national ocean policy outlined in our report, several key elements are required: the will to move forward, the actors to carry out the changes, and the resources to support sustainable management of our oceans and coasts. Congress and the President have already demonstrated political will by enacting the Oceans Act of 2000 and appointing the U.S. Commission on Ocean Policy. Our preliminary report specifies who should carry out each recommendation and discusses what the costs will be and how they can be covered.

Who Should Take Action

In our report, we make 198 specific recommendations to implement a more coordinated and comprehensive national ocean policy. One of our goals was to ensure that every recommendation was aimed at a clear responsible party who could take action and be held accountable over time. As you read the report, you will see the recommendations grouped according to subject area. However, to highlight the assignment of responsibility, we also present a summary of all 198 recommendations, organized by the primary actors, in Chapter 31.

In brief:

—We include 54 recommendations for Congress, 69 for Executive Branch leaders, and 125 for Federal Government agencies.

—Of the 69 recommendations for Executive Branch leaders, 8 recommendations are for the President, 45 for the new National Ocean Council, 13 for the offices under the NOC's Committee on Ocean Science, Education, Technology, and Operations, 2 for the Assistant to the President, and 1 for the Presidential Council of Advisors on Ocean Policy.

—Of the 125 recommendations aimed at Federal Government agencies, 44 are for NOAA, 20 for EPA, 10 for the U.S. Coast Guard, 9 for NSF, 9 for the Department of the Interior, 8 for the U.S. Navy, 8 for the Department of State, 6 for the Department of Transportation, 5 for NASA, 3 for the National Institute of Environmental Health Sciences, 2 for the U.S. Army Corps of Engineers, 2 for the Department of Agriculture, and 1 for the Department of Labor.

(Note that some recommendations include more than one actor. As a result, the breakdown by organization adds up to more than 198.)

Although we have avoided targeting States (and local, territorial, and tribal governments) as the primary actors in our recommendations, they have a critically important role to play in the new National Ocean Policy Framework—through establishment of regional ocean councils, and in areas such as coastal development, water quality, education, natural hazards planning, fishery management, habitat conservation, and much more. States should also participate in the design and implementation of regional ocean observing systems and their integration into the national IOOS, as well as other research and monitoring activities.

How Can the Needed Changes be Achieved: Costs and Revenues

The recommendations I've just alluded to outline a series of ambitious proposals for improving the use and protection of the nation's oceans and coasts. But meaningful change requires meaningful investments. In the case of the ocean, such investments are easy to justify.

As I explained earlier and as we discuss in more detail in the preliminary report, more than $1 trillion, or one-tenth of the nation's annual gross domestic product, is generated each year within communities immediately adjacent to the coast. By including the economic contribution from all coastal watershed counties, that number jumps to around $5 trillion, or fully one-half of our nation's economy. Those contributions are threatened by continued degradation of ocean and coastal environments and resources.

Modest levels of new funding will reap substantial dividends by supporting new management strategies to sustain our ocean and coastal resources and maximize their long-term value.

Costs

From the start, this Commission pledged to be clear about the costs of its recommendations. In keeping with that goal, the final report will include a complete accounting of the startup, short-term, and continuing costs associated with each issue area, including an analysis of Federal, State, and local budget implications to the extent possible.

At this stage, I am able to provide a rough estimate of overall new Federal spending associated with the Commission's preliminary recommendations. The Commission continues to refine its calculations and the information on which they are based, and will have more detailed costs and revenue estimates in the final report to the Congress and the President.

The total estimated additional cost for initiatives outlined in our report will be approximately: $1.2 billion in the first year, $2.4 billion in the second year, and $3.2 billion per year in ongoing costs thereafter.

A few special investments are worth highlighting:

—Creation of the National Ocean Council and related elements, with first-year costs of $1 million and ongoing annual costs of $2 million.

—Expansion of ocean education programs, with first-year costs of $7 million, second year costs of $251 million, and ongoing annual costs of $246 million.

—Establishment of an integrated ocean observing system, with first-year costs of $290 million, second-year costs of $312 million, and ongoing annual costs of $652 million.

—Increased ocean science and exploration, with first-year costs of $230 million, second-year costs of $395 million, and ongoing annual costs of $760 million.

—Dedicated Federal support for needed State actions, with first-year costs of $500 million, second-year costs of $750 million, and ongoing annual costs of $1 billion.

In view of the value generated by the ocean and coastal economy, we believe these are very reasonable investments.

Revenue: Creation of an Ocean Policy Trust Fund

Mindful of intense budgetary pressures at both Federal and State levels—and sensitive to the hardship associated with unfunded Federal mandates—the Commission set out to identify appropriate sources of revenue to cover the cost of its recommendations. A logical, responsible funding strategy is outlined in the preliminary report and will be developed further in the final report.

The Commission proposes creation of an Ocean Policy Trust Fund composed of rents generated from permitted uses in Federal waters. The Fund would include Outer Continental Shelf oil and gas revenues that are not currently committed. It would support the additional responsibilities we suggest for Federal agencies and prevent the creation of unfunded mandates to states.

The critical nature of the nation's oceans assets and the challenges faced in managing them make it clear that the time has come to establish an Ocean Policy Trust Fund in the U.S. Treasury to assist Federal agencies and State governments in carrying out the comprehensive ocean policy recommended by this Commission.

The Fund would include Federal revenues from Outer Continental Shelf oil and gas development that are not currently committed to other funds. The Land and Water Conservation Fund, the National Historic Preservation Fund, and the OCS oil and gas revenues given to coastal states from the three mile area seaward of their submerged lands would not be affected. After those programs were funded, in accordance with law, the remaining OCS monies would be deposited into the Ocean Policy Trust Fund.

Additional funds may also become available based on new offshore activities. In several sections of the preliminary report we discuss revenues that may be generated from permitted uses of Federal waters. In general, when a resource is publicly-owned, its use by private profit-making entities should be contingent on a reasonable return to taxpayers. Creating a link between permitted activities in Federal waters and the cost of associated regulatory and management responsibilities is logical and well justified by precedents in Federal land management.

Approximately $5 billion is generated annually from OCS oil and gas revenues. Protecting the three programs noted above would remove about $1 billion. Thus, some $4 billion would remain available for the Ocean Policy Trust Fund each year under current projections. At this time it is not possible to specify the amount of revenue that might be produced by emerging uses in Federal waters, nor predict when they may begin to flow.

The report recommends that a portion of the revenues received from the use of offshore resources be granted to States for the conservation and sustainable development of renewable ocean and coastal resources. OCS oil and gas producing States should receive a larger portion of such revenues to address the impacts on their States from extraction activities in adjacent Federal offshore waters.

In the Commission's view, Trust Fund monies should be used exclusively to support improved ocean and coastal management consistent with the nation's new coordinated and comprehensive national ocean policy. Such funds would be used to supplement—not replace—existing appropriations for ocean and coastal programs, and to fund new or expanded duties.

CLOSING STATEMENT

What I have presented to you today is a broad overview of the Commission's preliminary report—the culmination of 2½ years of work by 16 dedicated commissioners, 26 world-class science advisors, and a tireless staff of experts. To create this report, the Commission heard testimony and collected other information that shaped our understanding of the most pressing issues facing our nation's oceans and coasts.

The Commission balanced environmental, technical, economic, and scientific factors in making its recommendations. These bold recommendations for reform call for immediate implementation, while it is still possible to reverse distressing declines, seize exciting opportunities, and sustain the oceans and their valuable assets for future generations. Clearly, the Commission's recommendations will require some new investments. However, without major change, the tremendous potential of our oceans and coasts to American prosperity will continue to deteriorate.

It has taken more than 35 years for the nation to refocus its attention on these vital resources. Our report provides a blueprint for the 21st century to achieve a future where our oceans and coasts are clean, safe, and sustainably managed and continue to contribute significantly to the well being of all the nation's citizens. The time to act is now and everyone who cares about the oceans and coasts must play a part. Leadership from this Committee and others in Congress, and from the White House, will be essential and we look forward to working closely with all of you in the months and years to come.

Senator GREGG. Senator Stevens.

Chairman STEVENS. Mr. Chairman, I would be interested if other members of the panel would like to make comments before we begin asking questions.

Mr. Sandifer, do you have any questions, any comments? Ed? Mr. Rosenberg?

Admiral WATKINS. We have another commissioner, Professor Marc Hershman, sitting right here in the corner.

Marc, do you have anything?

Chairman STEVENS. Thank you very much.

I am interested, to begin with, in the integrated ocean observing system. Is there a cost factor associated with that? Has that been costed out?

Admiral WATKINS. Yes, there is, Senator. In our report we list it as the first year, $290 million, second year, $310 million, and a continuing cost over time of $652 million. And in our report we go further than that. We have a whole host of other things that are

independent but somewhat related in ocean science and exploration, in support for the States. We have another category called all over recommendations, which includes the estimated cost of a whole host of small issues, such as organizational change costs, the cost of running a national ocean council, about $1 million a year, that kind of thing.

But the answer to your question is costed out in our table 30.1, estimated cost of recommendations, and the cost of the integrated ocean observing system is pretty well flushed out with all the Federal agencies through the National Ocean Partnership Program. We actually have an office called Ocean.US that is supposed to be managing the program, getting the architectural design, and so forth. They have not been given the support they need. This is one of the hopes we have and one of the recommendations in the report, that we establish that office officially, that it comes under the National Ocean Council's purview, and that we get on with building the system as a component of the Earth observing system endorsed at the G–8 meeting in Tokyo and prior to that in France.

Chairman STEVENS. What is the IOC for that, Admiral?

Admiral WATKINS. Pardon me?

Chairman STEVENS. How long would it be before it was up and running?

Admiral WATKINS. Pieces of it are up and running now, as you know. We have a research set of buoys in the Pacific that tell us about the advances of El Niño, so they will be part of it. But I would say it is probably going to take 5 to 10 years to get this thing going, but it ought to be on a track that you all can watch up here and not just sit giving money to the researchers. We are not asking for that. We are saying no, we want to get applied research, we want to get funding for the system to actually field this. A lot of this can be fielded now if we put the resources behind it, and we know how to do that internationally. We know how to connect with the international community that also wants the United States to take a leadership role in this area.

So I think that we are ready to move. We know what the research ought to be. We know what the applied research ought to be, we know what instruments we ought to have today, and we know that we do not have adequate instruments in the whole area of living marine resources, for example, biological instruments. They are being developed by our researchers as best they can but those things need funding and need focus and each region should make demands on us to say here is what we need for products coming out of your database. We need these products in the Southeast, these in Alaska, these in the Northeast, these in the Great Lakes region. They are different, yet we can help coordinate all that and provide it.

So I would say if you had one recommendation that could pull all these communities together, it is probably going to be integrated ocean observing systems. That includes a major and very underfunded coastal ocean observing system. Currently, our biggest observations are in the middle of the oceans, not ashore, and the nearshore area is the most complicated to observe and monitor.

Chairman STEVENS. Well, years ago we financed dropping some similar sensors that were floating. They just floated with the cur-

rents. This recommendation includes ships, airplanes, satellites, buoys, and drifters that are used for mounting or deploying instruments, sensors, or other components.

The architecture of that, we need to get some details about ships. Are we to borrow ships from the Navy? Are we supposed to put these on Navy ships or on Coast Guard ships? Has someone got a layout of that, what it will take to really say it is up and running?

Admiral WATKINS. There is a whole different set of issues connected with funding the marine facilities. Oceans Act 2000 asked us to do a marine facility review, both public and private. It is an appendix to our report that is about 1½ inches thick. It is huge and it says these resources are getting old, they are inadequate to the task. We need to put some infrastructure monies back into these and get these things going. Okay, so we have that.

We have the UNOLS fleet, the University Ocean Laboratory fleet. It is getting old. It is going to have to be replaced, or pieces of it have to be replaced. We are looking at modern technology and development of new technologies in the future that may minimize the number of ships we have to put out there, but we have to put ships out there.

In fact, one of the expenditures we are asking for in the research area is a $70 million research vessel and submersible dedicated to ocean exploration. So in the ocean exploration initiative up here in the Senate we are saying we need that as part of this whole program.

We have $445 million over 20 years for the academic fleet, the Federal ocean facilities program.

These costs are different from those associated with implementation of an integrated ocean observing system. That is why you add up to $1.27 billion in the first year, and these are funds that can be sent now. There are plans available but there is no money to support the modernization of the research vessels that are essential over the next, say, 20 years.

Chairman STEVENS. I have just been told I have not been speaking loud enough. You know, that is not a normal comment for me.

Admiral, this IOOS, you gave us the money for it. Is there any item in your report that would have priority over that from the point of view of funding?

Admiral WATKINS. Well, you are asking somebody, Chairman Stevens, that believes that it is going to be very difficult for us to say that is more important than some of the things that we are recommending to keep from eliminating certain fish stocks, for example. I cannot put a priority on it that says that is so important that you can give up all of these other areas. That is my problem.

We are going to do the best we can in the final report and we have made a note in this section, the funding section of chapter 30, that we have to do a better job of laying out some of these issues in a way that perhaps is in more detail than we have in here today. Some of these costs are solid, they are hard; some are soft. We are going to try to harden those up and to try to give you more of a sense of priorities, but I am just worried that the IOOS alone is not going to solve all the problems.

It is terrifically important, it is absolutely essential to the game, but so are a lot of other things that we are mentioning in here in

the interim before we can build that system over the next 5 years. There are things we can do out there today over the next couple of years and they should be funded, too.

So I cannot give you a much better answer. I know that is not as clean as you would like to hear it, but I cannot do much better than that.

Chairman STEVENS. I will just tell you our problem. We already have a budget, not only the President's budget but we almost have the congressional budget, and there is no money in there for any of this. So we are going to have to see if we can find any money this year to try to get started. Now this is money for 2005, so if you want money for 2005 we have to find some and we have to find some in an amount that is doable within this subcommittee that my friends here are the cardinals of. I am not the pope but they are cardinals.

We must find some portion of this this year. We cannot run over $1 billion on this in 2005. I am sure you understand that.

Admiral WATKINS. I understand that.

Chairman STEVENS. So what we need to do is have some priorities. What could we do now to start certain portions of this budget off for this proposal by saying if we had this money, this money and this money in 2005, we could be on our way toward implementation of this report?

Admiral WATKINS. Well, of course, we have recommended a National Ocean Council. If the Congress believes that that is important—and we do—and establishes that council, you could say all right, we only have, against your total needs of $1.27 billion, we can give you $400 million in 2005 but you cannot spend any of those dollars until you come back to us with a priority plan to integrate all these things and do the best you can with these recommendations and then tell us what you are going to do to start submitting these things in 2006 and out-years so that we have some feeling that you are committed to this.

And if the administration is committed to it, at least they can take those and come back to you with a plan, and then you authorize them to go ahead with outlay toward that plan.

So I think there are ways to get around it if you can find any dough at all, and I understand that. This morning we were kind of chastised, saying, "You are not going to get the money." It is not us. I am not getting anything out of this. I love the subject. It is the American people who are not going to get it. That is the tragedy.

I am just saying as much as you can squeeze out of the system and demand that the administration come back with their plan, their integrated plan to carry out the priorities here. That is for the National Ocean Council to determine what those priorities are, along with consultation with the Congress.

Chairman STEVENS. I like that approach. Thank you very much, Mr. Chairman.

Senator GREGG. I also like that approach and think it is doable.

In your opinion, how much of what you are talking about is going to require authorization language? That would have to be in place before we could appropriate for it.

Admiral WATKINS. Let me ask the Executive Director to pick that up.

Mr. KITSOS. Well, we think that the establishment of the National Ocean Council would require codification at some point. Our report does note that the President could probably establish this by Executive order, but we suggest that if, in fact, he does that quickly, Congress could come along shortly after that and codify it. That would require authorization and also the trust fund that we spoke about would require legislative action by Congress.

Senator GREGG. Well, the trust fund has some problematic points to it which are obvious, which is that it is deemed general fund revenue, so you are not enlarging the pie. You are simply grabbing a part of the pie that is going somewhere else and saying it belongs with the oceans, and that is always a difficult exercise because whoever you took it from is going to say no, it does not. We all recognize that, I think.

You did mention, Admiral, and your report mentions you are basically, for lack of a better characterization, suggesting that we set up something to deal with wind farms and fish farms. Some might call zoning for the ocean. Is that right?

Admiral WATKINS. No, it is not. We are not zoning enthusiasts. Let me ask—who would like to take that—Dr. Rosenberg.

Mr. ROSENBERG. Senator, I think the idea is not that you decide in advance what areas you allow particular activities in but right now we have no structure by which you can determine that, for example, an exclusive use of a piece of the ocean can be allowed for a particular activity, except for offshore oil and gas. So if you wanted to establish an offshore aquaculture facility in Federal waters right now, what is the mechanism by which you would actually lease to some business or entity that area because it would preclude other uses, such as commercial fishing, in that particular geographic location. Certainly they would need some protections.

You also have a rather incomplete and not very clear structure for making the determination on whether it is appropriate to actually license a particular proposal. Of course you have National Environmental Policy Act kinds of considerations but the principal authorities are discharge permits from the Environmental Protection Agency and the Rivers and Harbors Act. In other words, do not put it in a place where you are going to run a boat into it. And, of course, there are other considerations, whether it be a wind farm or bioprospecting site or aquaculture facility.

So what we are suggesting is that we establish a clear set of policies by which those activities can move forward that also provides the opportunity for somebody who wants to propose such an activity to have both a point of contact and a clear process so that they could say okay, this is what I need to do if I want to establish my aquaculture facility or wind farm or whatever. Right now there is no regulatory or policy structure to do that in any clear fashion.

So we are not suggesting anything related to zoning. We are suggesting that there be a management system that allows these things to be considered in an appropriate fashion and be established, of course, if they meet those criteria, and I do not think that exists——

Senator GREGG. If you want to put a fish farm off of New Hampshire, which I think has already occurred, there is no permitting process?

Mr. ROSENBERG. There is but, of course, the offshore aquaculture research farm that you are very familiar with at the University of New Hampshire is in State waters, not in Federal waters. And second, the permitting process for commercial facilities would relate to again the Rivers and Harbors Act and a discharge permit, with commenting authority from the resource agencies—National Marine Fisheries Service and potentially the Fish and Wildlife Service—who could say well, we have these concerns. Then locally you would go for a permit and statewide you would go for a permit.

There can be in some cases for aquaculture facilities 25 different places you need to get a permit from before you can establish the facility. There is no comprehensive structure on aquaculture.

The same thing is true for bioprospecting. If some company wants to be able to investigate the biological resources that they might develop, for example, pharmaceuticals from in an exclusive piece of the ocean bottom, they have no way by which they can say all right, we are going to have the rights to look in this area for a period of time and we agree to do the following things when we do that. There is no management structure.

Senator GREGG. Do you see this as preempting State law, then?

Mr. ROSENBERG. No, certainly not, because we are talking about Federal waters now. We hope that it would help the States by providing a point of contact, but the States have authority certainly within 3 miles.

Senator GREGG. We now have a vote and we are 5 minutes into the vote. We can either recess and come back or if somebody wants to ask questions? Senator Burns is next.

Senator BURNS. I just want to make a comment as far as appropriators and where we find this money. Right now we are recommending the expenditure of quite a lot of revenue but not finding any more revenue coming into the Treasury with which to pay for that. And I guess that is where I will be coming from, how we look at that and how we fund this thing and your recommendations here, how they mesh with what else we have to do with that particular fund, like the offshore funds that come in, the OCS funds. I will be looking at that more than anything else. That falls under my purview. So we will probably have quite a lot of discussions with regard to that.

But your report, this is as aggressive a report and idea as we have seen since I have been in the Congress with regard to policy toward our oceans and I thank you for that because I think we have to go one step beyond before we get anybody's attention, before we really start moving on some of the problems that we see with our oceans. So I thank you for your work.

Admiral WATKINS. Thank you, Senator Burns.

Senator LEAHY. Mr. Chairman?

Chairman STEVENS. I got your message.

Senator LEAHY. I am just glad to see here that you are going to be the pope. I sent to Senator Stevens a note that my mother always wished I might make it as far as bishop. Bless her sweet immigrant soul, I never got quite as high as Senator Stevens. But I

want to thank him for holding the hearing. I want to congratulate Senator Hollings for his vision, helping to launch the Ocean Commission and the development of this important report.

Admiral Watkins, it is nice to see you. It has been a couple of years. It is good to have you and all your colleagues here.

I am going to miss Senator Hollings' championship of the oceans and sponsoring and supporting programs that protect this valuable resource. What he has done for our ecosystem is amazing.

I also want to acknowledge the Ocean Commission for a very thorough, very thoughtful report. I hope it gets a lot of coverage. Take that report and the Pew Ocean Report and they are the first real comprehensive reviews of ocean policies in 35 years, before I even came to the Senate. The recommendations in the two reports are somewhat different but they both do one thing; they ring the alarm bells very, very clearly. They highlight some of the changes I have been witnessing over the years, not from a scientific point of view but just as an individual.

I started exploring coral reefs and other ocean ecosystems over 30 years ago. I am an avid diver and beginning about 10 or 15 years ago I began to notice that some of these same reefs that we used to snorkel on were gone. They were gone and the fish around them were gone. The ecosystem had been destroyed. Because of these changes, over the years I dove more with the idea of seeing what the changes are, again not as a scientist but just as an individual. Except in rare instances, the changes have not been for the better.

So I am glad we are having this hearing on the anniversary of Earth Day. Although Congress enacted the pivotal environmental protection acts of our Nation so that we have clean air, safe drinking water, and cleaner rivers and streams, the report shows our oceans and coastal resources have fallen between the gaps in our environmental and natural resource policy webs. I think our ocean policies have not kept pace with the demands we have put on this.

Admiral, you and the others know the oceans look very, very big and look inexhaustible. You also know they are not. We cannot treat the oceans as bottomless pits and harvest their fisheries at will or pollute them or plunder them or grab what we want for this year's harvest, irrespective of next year's harvest and the year after and the year after that.

Just like we needed in the environmental acts of the early 1970s to reverse the course of the polluting of our lakes, rivers, and air, we have to do something similar for our oceans—create policies geared toward restoration and sustainable things.

I am not saying anything to you that you do not know but I think about the coral reefs I saw 30 years ago versus what I see now. I think what my children might see or my three, or soon to be three grandchildren might see. I am afraid they are not going to see the things that we saw and maybe their children never will. It is really our responsibility to make sure something is done to protect the oceans.

I will submit, because of the vote, Mr. Chairman, some questions for the record. I know we need money, we need vision. These people have given us some vision and it is up to us to get the money and

I think on this topic maybe the cardinals in this committee might find some of that money.

Admiral WATKINS. Mr. Chairman, Ed Rasmuson has a comment.

Mr. RASMUSON. Senator Leahy, I thank you for those comments. Briefly, 3½ years ago this Commission was constituted. We spent a lot of hard work on it. We have come up with what we think are concrete recommendations.

You knew when you put this Commission together it was going to cost us money and I submit that we cannot afford not to start. We have done the best we can with first, second and third years of costs and the worst thing that I would fear is if this thing that we have worked on is shelved and nothing was done and what have I wasted all my time for?

None of us here, all 16 of us worked hard, plus the staff, and we are submitting to you that we would like to get some money in the 2005 appropriation and then be allowed to flesh out, as the Admiral said, the real priorities for the second and third year. And I submit in these priorities that our cornerstone of what we have come up with is the necessary dollars for research and education. Without that, nothing is going to happen. Thank you.

Senator LEAHY. Well, this Senator is not going to put the report on the shelf, I can assure you, and I expect to be on this committee for years to come. Thank you.

Chairman STEVENS. Senator Cochran.

Senator COCHRAN. Mr. Chairman, thank you.

Admiral Watkins, thank you. We appreciate the fine work that you and the members of this Commission have done. It is very impressive. This is an overview of 2½ years' work that we are getting today and I am glad that we have an opportunity to see what some of your recommendations are.

Just a few weeks ago I had the pleasure of visiting the National Data Buoy Center at Stennis Space Center on the Mississippi gulf coast and I was impressed with the worldwide reach and effect that that center has and the responsibilities that it has. I am curious to know whether you make any recommendations about the continuation of the work of the National Data Buoy Center or some new incarnation of that center. Is there a specific proposal that you have come up with at this point to make with respect to the center?

Admiral WATKINS. God bless you, Senator Cochran. I am the one that started out 2½ years ago saying data collection, data assimilation, conversion of that data to useful products for the good of the country is one of our highest priorities. If we do not do that, I do not see how we are going to understand things like climate change, nonpoint source pollution, the decay of our reefs, the loss of the fisheries. We are not going to do it unless we bring all of these databases together. And where best to do it than at Stennis. They have the Center for Excellence for the Department of Defense. They know how to take disparate databases and bring them together. They know how to produce products out of those data that does not boggle the mind.

We are not talking about scientific information coming out of there, except for the researchers. We are talking about conversion of those data to useful decisionmaking products. That is in our recommendations.

So when we went down to Stennis we were impressed by the defense capability, and they are probably the only one in the Nation that can do the kinds of things we are talking about here, to assimilate large volumes of data, the NOAA database, the Navy database, the local database, the fisherman database, and databases on socioeconomic aspects. We cannot forget that human beings are out there and we do not want to destroy communities. We want to understand who they are, where they are, what their needs are and at least listen to them, and we are not doing that today.

So the data assimilation and use is vital to this and it is one of our strong recommendations, that the National Ocean Council make sure that that is set up, that it is funded, and that people can begin to play in that game. And that gets back to the locals, the counties and the States. They need to have access to that information, converted to useful products, and they need to make a contribution to it, and we have called that the regional ocean information program. We want the regions to set up those programs because they know they need the information the programs would produce.

And I do not see any outfit in the country that can do what you can do in the Defense Department at Stennis for this purpose, with a lot of consultation with people like the Navy, who are ready to do this kind of work for us.

Senator COCHRAN. Thank you very much. I hate to have to go vote but I have to do it.

Do you want me to vote for you?

Chairman STEVENS. Yes. Someone did vote for me once. They are going to hold the vote until we get there and when Senator Gregg comes back we will leave, and I think we will wind up the hearing when he comes back, very frankly. I do appreciate your help.

I did introduce a bill that deals with national ocean exploration and I do hope that we can get it considered each year. I do not know if you are familiar with it. It tracks considerably what you have recommended. But I still am very worried about the funding stream that we need for this. There is no question that the funding stream is there. Two-thirds of the Outer Continental Shelf off Alaska and not one well drilled in it yet. We ought to find some way to find new revenue streams to meet this need and I would hope that you would work with us, the people you talk to.

We only need two votes to pass the energy program and there is such a fund already in the energy bill. We really need money to meet your needs.

I want to close my part of this by thanking each of you for your work. Senator Hollings and I have dreamed of getting such a commission going and you have fulfilled our dreams because you have worked hard and produced something I think is salable and financable and practical and attainable if we only can get the revenue streams established that will sustain it.

So I do believe you have done a great service for the country and I hope to work with you in years to come and see that your report is fulfilled.

Admiral WATKINS. Thank you very much, Mr. Chairman.

Chairman STEVENS. I think we will have to stand in recess now and wait for Senator Gregg's return.

Do you have a timeframe, Admiral?

Admiral WATKINS. Yes, sir, we do.

Chairman STEVENS. It has passed already?

Admiral WATKINS. No, no, no. We are ready to do work. This is pretty important to us.

Chairman STEVENS. I cannot say that Senator Gregg does not have any more questions but I do not have any more, obviously, but I do appreciate what you have done. Thank you.

Admiral WATKINS. Thank you.

Senator GREGG. Okay, I appreciate everybody's patience. This happens when we have votes, which is part of our job.

I understand that Senator Stevens, Senator Cochran, Senator Burns and Senator Leahy all had an opportunity to at least briefly inquire and I certainly appreciate your willingness to go through two hearings today, the Commerce Committee and the Appropriations Committee.

I did have a couple of other quick questions I wanted to get addressed. One is the division in the fisheries area between research and managing the fisheries. That seems to be an artificial division you are proposing because there is a fair amount of overlap of those two exercises, is there not?

Admiral WATKINS. Dr. Sandifer.

Mr. SANDIFER. Thank you, Mr. Chairman. Within the fisheries management side we are suggesting that the science part of the management decision be separated from the allocation decision so as to ensure that the allocation decision is based on the best science and there is no potential for any conflicts of interest.

Within the agency as a whole, we also make some recommendations that NOAA has three principal missions. One of those missions is the assessment, prediction and operation, including things like the Weather Service, would include the integrated ocean observing system, charting, and all of those kinds of things. Then there is resource management that is far more than just fisheries but also includes coastal zone management, protected area management, like the sanctuaries and estuarine research reserves. And the third area obviously is the science, research and education function that could be organized probably in a way that would better support the overall mission of the agency.

It is much broader than fisheries because we are recommending throughout this report that we take an ecosystem approach to all resource management related to the oceans, not just for fisheries. And the science structure then should be organized to better reflect that ecosystem basis, we believe.

Senator GREGG. Okay. Well, how much pressure do you think the fisheries are under and to what extent are we funding the correct areas? We spend a lot of money on fisheries. Did you take a look at whether the money we are spending is addressing the fisheries that are in need or is it more arbitrary?

Admiral WATKINS. Dr. Rosenberg will take that.

Mr. ROSENBERG. Senator, I think that yes, we do spend a lot of money on fisheries but there are some major both research and science advice questions, as well as management problems within fisheries. By and large, I do think that we spend the money well, if you like, although we certainly struggle particularly with things

such as social and economic data in the fisheries area, and fisheries information systems I would have to say on the research side.

On the management side, the council system struggles with their funding needs. They have a very large mandate in terms of developing fishery management plans and frankly do it with not very much money. I do not know the total budget for fisheries management councils but I am going to guess the last I knew it was about $13 million or something like that. And, at the same time, they are being asked and the Fisheries Service is being asked to be more comprehensive in their analysis of impacts, both on communities as well as on biological resources.

So part of the push here for additional funding for research and for integration of management within our proposals do, I think, help that fisheries picture, particularly on the social and economic side.

To add a little bit to what Paul said on the separation between the science and allocation, we are suggesting that within the council process—it is a somewhat different matter within the agency per se because, of course, it is the councils that recommend allocation decisions, not the agency. And we talked with the council chairs yesterday, the Fishery Management Council chairs yesterday in a briefing and I think came to a fairly clear understanding of what the recommendation was. It is really furthering what they are trying to do in terms of regularizing peer review processes for developing the science within the system. So that part of it, I think, is fairly clear.

Mr. RASMUSON. Senator Gregg, one of the things, as Andy pointed out, the councils themselves—there are eight councils—have about a $13.5 or $14 million budget but what they really need is more dollars going into research and science and this would help all the councils, as well as NMFS, so that we have better science in order to make our decisions and, as a result, we will have, I think, less environmental suits brought on by various interest groups because we will all be able to share in the same science and we will have a better idea of what we are doing. That is one of the mandates you gave us 3½ years ago.

Senator GREGG. I agree, so I am glad you addressed that.

On a separate issue, I know you discussed this at considerable length this morning but just for the record, I am equally interested in whether NOAA should be an independent agency and whether it should be raised in its visibility.

Certainly your suggestion, Admiral, that we are going to incrementally move into better ocean policy and as part of that incremental movement we will learn to walk before we run makes a lot of sense as a way to approach things, rather than just a massive reorganization. But I think the end product will be or should be considered to be a NOAA that has much more strength and stamina and probably is a free-standing vehicle, a free-standing entity.

Admiral WATKINS. I think, Senator Gregg, we have debated this at great length and we have communicated back and forth with key membership on the Hill here about this. We believe that there is so much to be done here within the existing structure that if we move out too aggressively on organizational restructuring of the

Federal Government, our energies are going to be so devoted to that that we are going to lose the forest for the trees.

We have a lot of things to do here——

Senator GREGG. I agree with that.

Admiral WATKINS [continuing]. Within the existing system, so we are saying let us strengthen NOAA, let us give it a new underpinning from the Congress, let us give NOAA new responsibilities, like being the lead agency for running the integrated ocean observing system. They are not ready to do that now in an ecosystem management context. Their fiefdoms are set up in ways that are isolated from each other and we need to break that and go back to a whole new way of doing things.

We have recommended principles under which an organic act for NOAA would make a lot of sense. Once we do that, then we have a functional NOAA set up with an ecosystem-based approach and into that we can begin to take out those elements of redundancy that should be in NOAA that are now in Interior, in EPA, and so forth, and one section of the Corps of Engineers.

Pretty soon now we have built a Department called NOAA that is operating under an ecosystem approach, that is bringing in the functions from other agencies that ought to be in the oceans and atmosphere department, and somebody is going to look around and if they are running an integrated ocean observing system, which by the way, includes inputs from upland watershed monitoring. We cannot predict climate unless we monitor the land side, as well. What have we done? That is a natural resource department.

So 5 to 7 years from now if we do this and get serious about it, the Congress can stand up and say hey, we have done it and we have not lost any stitch in time here. We keep going with all of the programs we have and we can keep building on it.

Also I think there is another thing that we have done in this report that I think will make a lot of sense right in the near term. NOAA's budget is reviewed under the General Government Directorate of OMB. We want the NOAA budget to be reviewed under the Natural Resources Directorate, which does the EPA and the Interior Department, and all of the other resource agencies. So that is where NOAA ought to be.

Now pretty soon, with a budget examiner in natural resources and with a new NOAA under an organic act passed by the Congress, have you not built the equivalent of an independent agency without the unrest and upset that would otherwise be there if you tried to have some kind of a guillotine action, just as we were forced to do for Homeland Security? I think that this logical step approach, three-step approach, maybe it is too logical for this town but it is a right way to go, to step it up in a logical fashion so that we can do the other recommendations in here and carry them out in the near term.

There is no reason why we cannot do that. We are not doing it today because we do not have the formal structure. We are still going after individual species. We are still going after individual items. Are we going to solve the reef problem with a task force on reefs. No, we are not. We are kidding ourselves. The Department of Energy was set up and was very controversial. What do you need

an Energy Department for? But we did it. We did it because we were so scared because of the oil embargoes of the 1970s.

We do not want to get into that game. We do not think it is productive. We are not against an independent NOAA. We are against moving so quickly and so fast that we do not know what we are doing and we are going to stumble on the way and who gets hurt? The fisheries, the estuarine areas, the productivity of the country, and so forth. So that is why we have taken this approach to it.

Senator GREGG. Well, I think it is the right approach. I think the end product, I hope, will develop the way you see it. It is a logical and excellent road map for us to follow, and I will certainly do all I can to see that we do follow it.

On the issue of how we fund this with the trust fund, that is a problem. I am thinking just prematurely that maybe it is a prospective event, versus looking backwards, and if you were to do this prospectively you would have much more chance of getting those funds allocated. It would build up fairly quickly, depending on what the sources were, rather than to try to grab money that is already being allocated places.

COMMITTEE RECESS

But in any event, we very much appreciate your work. We know you put thousands of hours into this. Your staff did an excellent job. You folks did an excellent job. You have really given us, as I have said a number of times, a road map. It is our job to follow it. We look forward to trying to do that, working with you. Thank you very much.

The hearing is recessed.

[Whereupon, at 3:05 p.m., Thursday, April 22, the committee was recessed, to reconvene subject to the call of the Chair.]

REPORT OF THE U.S. COMMISSION ON OCEAN POLICY

MONDAY, SEPTEMBER 27, 2004

U.S. SENATE,
SUBCOMMITTEE ON COMMERCE, JUSTICE, AND STATE,
THE JUDICIARY, AND RELATED AGENCIES,
COMMITTEE ON APPROPRIATIONS,
Durham, NH.

The subcommittee met at 10 a.m., in the Courtyard Reading Room, Diamond Library, University of New Hampshire, Durham, New Hampshire, Hon. Judd Gregg (chairman) presiding.

Present: Senator Gregg.

STATEMENT OF ANN WEAVER HART, PRESIDENT, UNIVERSITY OF NEW HAMPSHIRE

Ms. HART. Welcome all of you, especially welcome Senator Gregg and our panelists, Dr. Ballard, Dr. Rosenberg and Dr. Sandifer, and members of our audience, to this very important U.S. Senate hearing on the U.S. Commission on Ocean Policy.

The University of New Hampshire has played a significant and direct role in the Ocean Commission report with the involvement of our own Dr. Rosenberg and hosting earlier Commission field hearing.

UNH is also nationally known for its exploration of the oceans, coastal areas, and ocean-based management, all areas of important inquiry in the report; And of course, through our strong partnership with NOAA.

While this hearing will be conducted under the official rules of the U.S. Senate, it is also an educational event, especially for our students. And I want to take this opportunity to welcome all the UNH students who were able to come here this morning and thank you for participating in this very important process of making national policy.

It addresses issues of importance to the future of our oceans and has a direct impact on our continuing involvement in the forefront of marine research and education.

I am proud that the University of New Hampshire has been chosen to host this event. And I now turn to our very own Senator Judd Gregg to begin the official U.S. Senate hearing.

Senator GREGG. Thank you. Thank you, President Hart. And thank you for making the university's facilities available to us today. And it is a great pleasure to be here at UNH, which has been such a leader in the area of marine biology and biology gen-

erally, atmospherics and marine, nationally and internationally, and is certainly the appropriate forum for us to hold this hearing.

We are doing it a little different than the typical Senate hearing in that I have always found Senate hearings to be fairly stilted and I wanted to have more of a discussion, especially between the panelists, who are such experts on how we approach the implementation of the U.S. Commission on Ocean Policy report, which some of you have had the chance to study in classes.

This is a fairly significant report and fairly long, also. And it is really a blueprint for how we propose to address what is one of the critical needs of the world, which is protecting and making sure that we continue to have a viable ocean policy protecting our oceans and the ecosystems which support them.

My role in this is that as chairman of the Commerce, State, Justice Subcommittee, which is a subcommittee of the Appropriations Committee—some of you who are familiar with Washington know that there are two sides to the process of Washington Government. One is the authorizing side and one is the appropriating side. Those of us who are appropriators tend to think there is really only one side, the appropriating side. But as a practical matter, the Appropriations Committee mirrors the authorizing committees, but has the responsibility for allocating and distributing funds. And the committee that I chair has the responsibility over NOAA, which obviously has the prime responsibility for oceans policy and programs. And so we do have direct responsibility for implementing, to the extent there is a role for the Federal Government, which is fairly significant in the proposals in the Commission report.

And the Commission report is actually an outgrowth of very much needed legislation which was introduced and championed by my ranking member, Senator Fritz Hollings from South Carolina. I participated with him, as did a number of other Senators, Senator Ted Stevens from Alaska being a major role player here. And that is why the Commission was set up and was asked to put this report forward, because there was a belief that we needed to focus on oceans and have a very independent and thoughtful group of people do that.

That brings us to today, which is to review the report and get ideas from the members of the Commission as to how we can best implement elements of the report.

The university's role in this is also obviously critical. Andy Rosenberg, of course, was a member of the Commission and played a major role in the Commission's findings. But more importantly than that, UNH has a unique niche as being one of the leading universities in the world in the area of marine biology, marine science; and therefore, has a very critical role in making sure that the interplay between the academic community and the people who have the hands-on responsibility, such as policymakers like myself, making sure that there is a tremendous flow back and forth of information and ideas. And so UNH's role in implementing the policies of the Commission's report is absolutely critical.

The planet, of course, is covered 70 percent by oceans, as all of you know. And there was a fellow named Arthur C. Clarke, who said instead of being called planet Earth, it should be called "plan-

et ocean," which is a pretty accurate statement of the implications of oceans relative to our lifestyle here as a Nation.

And this Commission has put forward 212 different recommendations as to how we can better address the issues of ocean policy. And we will discuss many of them here today, probably not all 212, but a few of them, anyway.

My subcommittee, the Commerce, State, Justice, has taken a very serious look at the Commission's report so far. We still have a lot of work to do, but we have been able, as a result of taking that serious look, do some funding activity that has been creative and been able to put approximately $414 million into initiatives which this Commission has asked for. It is not as much as the Commission wanted, I have to be honest about that, but it is a significant step in the right direction and quite a bit more than the House was able to do; and hopefully in conference, we will end up at the same place.

We are very fortunate today to have as part of our panel here three people who are true leaders in the area of ocean policy and were members of the U.S. Commission on Ocean Policy. And we are going to hear from all three. Let me start and work our way to the person we are going to hear from first.

We begin with Dr. Paul Sandifer, who is a senior scientist at NOAA for the National Center for Coastal and Ocean Science. Now, Dr. Sandifer has a very long history here in New England of being involved in a lot of issues. He is based out of South Carolina right now, but he was very active during some of our fish issues here in New Hampshire and we worked together on those. And he has a tremendous history and expertise in the area of ocean policy. And we are very fortunate to have him here today as one of our expert witnesses.

Of course, Andy Rosenberg needs no introduction here at UNH. He is a huge force, not only here at the university, but across the Nation, on ocean policy. And his leadership has been critical to getting good ideas put into the national agenda.

And our first witness who is going to talk to us today and give us some thoughts is Dr. Ballard, of course, who is sort of the successor to Jacques Cousteau in his ability to communicate with the world the importance of the ocean and to bring it into perspective that is exciting and vibrant and especially excites kids who are studying and thinking about what they are going to do with their lives about the opportunity of maybe getting involved in ocean policies.

His discovery obviously of the *Titanic* and the *Bismark* are classic, and we have all watched with great fascination the films he has made.

He is about to embark on a whole new exercise as he has gotten a new ship, and he is going to talk to us about that, that is going to give him the ability to reach out to literally tens of thousands of children across the United States and probably across the world and bring to them the importance of the ocean, but excite them about ocean policy and how we preserve these unique assets and resources.

So it is a great pleasure to have you here, Dr. Ballard, and we will turn it over to you.

STATEMENT OF ROBERT BALLARD, Ph.D., MEMBER, U.S. COMMISSION ON OCEAN POLICY; AND PROFESSOR, UNIVERSITY OF RHODE ISLAND

Mr. BALLARD. Thank you, Senator. And thank you, President Hart.

It is indeed an honor to be here. And I must say that it was an honor to serve on the President's Commission and I want to thank you for doing this historic thing.

It has only been twice in the history of our country that we have had an ocean commission. And the reports that we have submitted to the President and Congress is, as you said, sort of the blueprint that we hope our Nation will follow.

When we had a press interview a few minutes ago, the question was, well, how do you do it? And it is sort of like a 500-pound cake, a bite at a time. I think that the critical thing is the process has begun.

I was lucky as a commissioner to be put on the committee that dealt with my two passions: Ocean exploration and ocean education. In fact, for me, they are one and the same. We were able to come up with a wonderful new program. You will see it in the Commission deliberations. But not only did we come up with a wonderful plan, thanks to the Senator and his colleagues, we have begun implementing that plan.

The area of ocean exploration, just to calibrate it, NOAA's present program in ocean exploration is one-tenth of 1 percent of NASA's budget. I believe in space exploration. My father was an aerospace engineer. I lived with the Apollo program, as he helped build that system. So I am not adverse to space exploration. But I have to have, must say, I have a bias toward our own planet. In fact, as we sit here today, the maps we have of Mars are 250 times more accurate than the topographic maps of the southern hemisphere.

So clearly, we have just begun the age of exploration. I think we tend to think that exploration is in our history books. It is not in our rearview mirror; it is in front of us. And in fact, I like to point out to young people that their generation, the kids that are in middle school right now, their generation will explore more of Earth than all previous generations combined, thanks to the new advance technology of mapping and exploration.

We haven't even done the Lewis and Clark Expeditions—I should say Lois and Clark Expeditions in the southern hemisphere. And that is where I hope this new ship of exploration will concentrate its time, to go, in Star Trek terms, "to go where no one has gone before," and that is primarily the southern hemisphere, which is 85 percent of the southern hemisphere is oceans, far more than the northern hemisphere. Certainly the western Pacific, there are vast polar regions; there is so much of our planet that remains unexplored.

And yet, in the initial phases of exploration of even that small percentage that we have looked at, we have come to realize that the ocean held the key to an understanding, and the fundamental understanding, of how our Earth works.

It was really the explorations of the mid-ocean ridge that really led to a fundamental rethinking about global geology and the emer-

gence of the new concepts of plate tectonics; that came out of explorations of the land beneath the sea.

We also, in our early explorations of the mid-ocean ridge realized that there are more active volcanos beneath the sea than on land by orders of magnitude.

We also made discoveries, important mineral discoveries. And Karen VonDamm, who is here at the university, has been a pioneer in the exploration of high temperature hydrothermal vents that have helped explain—I can remember when I was a kid, I had a simple question for my teacher: Why was the ocean salty? You would have thought that they would have known; and yet, they didn't know.

And it wasn't until the discovery of these high temperature hydrothermal vents and we realized that the entire volume of the world's oceans is going inside of our planet and out every 6 to 8 million years. And when we took that second circulation system—we knew about the hydraulic system, but we did not know about the hydrothermal system—we finally were able to balance the equations and finally be able to answer that question, why is the ocean salty.

But also associated with that was the discovery of important mineral deposits. I think that when people talk about how are we going to pay for the ocean initiatives that are in our recommendation; by increasing the economic wealth of our Nation. And I think that when you look at the oceans of our planet that are unexplored, their economic potential has to be vast. The Easter bunny did not just put all the mineral resources on our land. There are vast mineral resources beneath the sea that have yet to be found and exploited.

Also, the discovery of whole new life systems on our planet. Discovering new life systems led us to realize that the way in which life may have evolved on our planet was fundamentally different than what we were being taught in our classrooms.

It has also greatly increased the probability of finding life elsewhere within our own solar system, all coming from explorations of the oceans.

And by the way, all of those things were not in our research grants to the National Science Foundation; all of those discoveries were serendipity, being in the right place at the right time.

Now, when you look at that, not only did we discover these new chemosynthetic life forms that are the driving engine of life in the vent systems, we also began to discover that the deep sea was an undersea museum.

Our discovery of the *Titanic* and the *Bismark* and the *Yorktown*, all of a sudden we realized that the deep sea was a preserver of history. More recently, we did a recent expedition back to the *Titanic*, where we are beginning to look at how one can conserve sites beneath the sea as sites for future memorials, future battlefields, future marine sanctuaries, just as we have on land.

But we have also begun to discover that the deep sea holds a history of ancient civilizations. We now think that over the course of time, the human race has lost over 1 million ships of antiquity, 1 million ships of antiquity that have gone to the bottom. Here is a ship just sitting on the bottom of the ocean that sank at the time

of Homer, 750 B.C., the first Phoenician ship ever discovered in the deep sea, just sitting there.

There are 1 million time capsules of human history in the ocean and yet, there is no major program to understand and find those pieces of human history, and more importantly, to protect them.

The deep sea is a giant museum. The question before our society is whether we are going through the doors of that museum to appreciate human history or to plunder it. And the jury is out. We have no legal regimes in the high seas to protect antiquity.

But what is important, though, is to begin this process. I happen to think that we may think we are pretty good, but all those discoveries I showed you was based upon looking at less than one-tenth of 1 percent of the world's oceans. I think we are pretty good, but I can't believe that in our explorations of one-tenth of 1 percent, we found everything. Absolutely not. There is no way that we found everything.

So people always say what are you going to find? Well, I think of when President Roosevelt assembled the National Academy when he became President, and he asked the National Academy, you are the great minds of our Nation, please tell me what the next 20, 30 years are going to bring, they missed everything. They missed computers, they missed rockets, they missed Salk vaccines.

I am a member of the scientific estate, but I also know our track record in predicting the future is not necessarily the greatest. So do not ask us what we are going to discover, just let us discover, let us explore.

And a giant step has been taken now with the creation of a new ship of exploration. Just think about it. Our Nation, for the first time in its history, has a ship of exploration. Thanks to the Senator and his colleagues, I want to thank you for that, because this is an historic moment I think we are going to be looking back upon. Future generations are going to be looking back upon the date when this new ship comes online and begins exploring with the phenomenal technology.

Because our assumption and our exploration paradigm is that the experts will not be on the ship. They have never been on the ship when we have made fundamental discoveries. Once in a while we got lucky; Lost City was a discovery where they happened to have the right people on the ship, but generally not. When we found hydrothermal vents, biggest biological discovery ever made, we didn't have any biologists on the expedition.

But due to this new concept of telepresent technology, we are going to be able to outfit this new ship with an incredible technology. Right now, we are using the Brown as our experimental laboratory for the development of this new exploratory technology that will come online in 2007.

But it has incredible vehicle systems that will be able to have round-the-clock communications with the bottom, up to the surface, in high band width. This is today's command control center aboard these research ships, a high fidelity, high definition plasma displays.

But then they are put on a satellite and they go up on a Ku band satellite, gyrostabilized; the ship can roll 15 degrees without loss of lock, can spin on its access without loss of lock.

We then downlink it up just north of here, in Maine, and we put it on Internet II. Internet II is the new kid on the block. Internet I is, to me, compare Internet I, the one we are all using now, to Internet II, it is a dirt road on the information highway compared to what we have on Internet II. Internet II's bandwidth is 10 gigabits; that is a pipe. It's like drinking information from a fire hydrant. And that permits it possible to create a telepresence at various sites.

We have been successful, just down south at the University of Rhode Island, where I am a professor of oceanography, we are on the ballot in the State of Rhode Island for a $14 million bond issue to build an Inner Space Center to link to the ship of exploration. We have built a prototype for our recent expedition on the *Titanic*.

We are able to send the entire experience ashore. So to scientists, our vision is that the ship of exploration will be out doing its thing, which mostly is surveying, it is mostly boring. What they say, what's it like to go to sea and search? Well, it is 99 percent boring with 1 percent of sheer terror and sheer excitement when you make that discovery.

When we make that discovery, we will be able to replicate the command center at the universities. And the beauty of this new system is to completely replicate the command center at sea is $25,000 because everything is front-end loaded. So it means that every university that's participating in a cruise can have that in their lab and be monitoring the expedition.

But the beauty of telepresence is having separated the physical body from the experience and put them in a telepresent environment is you can also put kids there. You can take—right next to the Inner Space Center that we are building is a full-up television production facility to be able to take the excitement of exploration, the excitement of discovery and send it right into the classrooms.

Fortunately, in the State of Rhode Island, all schools in the State of Rhode Island from kindergarten up are on Internet II right now. We have already wired all the schools in Rhode Island to Internet II, which means we can replicate the command centers in any school. And it is starting to creep into other schools. And I hope that New Hampshire, all their schools are on Internet II, because then they will be able to follow these explorations. Because our job is to take the future generation of explorers and get what we call a jaw drop. When you can get a jaw drop like that, then you know you have got them. And we hope through our allegiance with the Jason Project, through our important program with the Boys and Girls Clubs of America, that we are able to not only take these journeys of exploration and take them to the academic world for their realtime participation, but to get future explorers. Because if we can get a child to drop their jaw, we can put information into their mind. Thank you very much.

PREPARED STATEMENT

Senator GREGG. Thank you. Thank you very much. You can see that enthusiasm makes a big difference and really has an impact, obviously.

And we wouldn't have the Explorer unless it were for Dr. Ballard, quite honestly. It was his energy that caused the people

to be willing to put up the money and make the decision to go forward with it. And obviously, it's going to be a huge plus for the country and for the world.

[The statement follows:]

PREPARED STATEMENT OF ROBERT BALLARD

Webster defines the act of exploring as follows: "to penetrate into or range over for purposes of geographical discovery" "to make or conduct a systematic search".

Webster, on the other hand, defines the scientific method as follows: "principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses."

In other words, exploration results in the discovery of phenomenon that scientists then seek to explain. Our understanding of the chemistry of the world's oceans and the potential origin of life on earth, for example, came after the discovery of hydrothermal vents by others looking for something else.

As we begin to shape America's emerging program in Ocean Exploration it is critical that we seize this opportunity to explore the uncharted regions of our planet for the purpose of making new discoveries that scientists will then seek to explain "through observation, experimentation, and the formulation and testing of hypotheses."

Ocean Exploration should not just create a new source of funding for traditional oceanographic research. The budget for ocean exploration is small compared to that for oceanographic research. It must be spent wisely or the program will fail.

If one simply looks back into time, there are numerous successful examples of the exploration model. The voyages of Captain Cooke as well as Lewis and Clark's exploration of the Louisiana Purchase are excellent examples as are the more recent Challenger and Meteor Expeditions of the 19th and 20th Centuries, even the most recent Deep Sea Drilling Program of the 20th and 21st Centuries.

In all cases, these were not a series of scientific legs cobbled together, each having its own purpose, each involving a different group of scientists with their own particular research focus.

These were "systematic" search/survey programs conducted in large part by non-scientists. Instead, they were led by disciplined military officers willing to endure hardships while conducting systematic and at times boring survey efforts.

If one looks at the recent recommendations of the President's Ocean Policy Commission on Ocean Exploration, one sees that they clearly make the distinction between exploration and science. They further recommend that the initial phase of exploration should be conducted by NOAA not NSF and there are clearly reasons for this.

Before there was a NOAA, there was a U.S. Coast and Geodetic Survey that, like the Lewis and Clark Expedition, can trace its origins back to the exploratory mind of President Thomas Jefferson who in 1807 signed a bill for the "Survey of the Coast."

The Survey charted the nation's waterways, producing topographic maps of our shorelines, an effort that expanded with the acquisition of Alaska, the Philippines, Puerto Rico and the military needs associated with our Nation's global wars.

As a result of this long history, NOAA is ideally suited to be the lead agency for America's Ocean Exploration Program. But NOAA needs to return to its roots.

There is a growing criticism of NOAA's OE program that needs to be addressed. The loudest and strongest criticism is that the program, as it is presently structured, is not an Exploration Program. It is a bunch of individual Principle Investigators, myself included, "doing their own thing". It looks more like a "mini-NSF" program than an Exploration program. It is not surveying unexplored regions of the world.

The recommendations made by the 2000 NOAA Presidential Panel, the recent Academy Study, and the President's Commission, which is about to publish its final report, all say the same thing. The program should center around a large annual global/international expedition on a "flagship" for exploration. That is why the program needs a dedicated ship: so that it can get away from the normal "traffic patterns" of UNOLS and NOAA ships, which spend the vast majority of their time near the continental United States, and travel to the remote, uncharted regions of the world to conduct surveys—not science programs—in search of new discoveries. The scientific world can then react to these finding by developing research programs with funding from NSF and other sources.

Now, thanks to the efforts of Senator Gregg and his colleagues in the Senate, Senator Dodd, Hollings, Inouye, and Stevens, the USNA CAPABLE has been transferred from the U.S. Navy to NOAA. And America now has its first ship of exploration!

With this action completed, we must now insure that this ship of exploration does not fall into the traditional pattern of individual investigators doing their own thing in the well explored regions around the continental United States but that it goes where no one has gone before to the uncharted corners of our planet where new discoveries await us.

And when we make these new and exciting discoveries of new life forms, new mineral deposits, new fisheries, and find new natural and cultural wonders beneath the sea, let us make sure that the children of our nation are with us in "real time" on these voyages of discovery to excite and motivate them to become America's next generation of explorers.

Thank you very much for permitting me this opportunity to speak.

Senator GREGG. Dr. Sandifer is now going to give us his thoughts on what the policy should be relative to the Ocean Commission. I thought we would save Dr. Rosenberg for last, since he is the hometown boy, the cleanup hitter.

STATEMENT OF PAUL A. SANDIFER, Ph.D., MEMBER, U.S. COMMISSION ON OCEAN POLICY; AND SENIOR SCIENTIST, NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE, NATIONAL OCEAN SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. SANDIFER. Thank you, Chairman Gregg. I also want to, not only thank you for your tremendous support, but also my home State Senator, Senator Fritz Hollings, whose leadership made the Ocean Commission possible.

I had intended to follow Andy's lead, so pardon me as I digress a little bit from the script here. The Commission decided on four foundation blocks for its plans for comprehensive national ocean policy. These are improved governance, ecosystem-based management and more emphasis on science and education.

Andy is going to cover the governance and the ecosystem management issues. I want to focus a little bit of attention on the other two areas, that is, increased utilization of science for decision-making and education.

Despite the extraordinary efforts in leadership of this committee and Senator Gregg, ocean science is still woefully underfunded. To deal with this problem, the U.S. Commission on Ocean Policy has recommended a doubling of Federal ocean, coastal and Great Lakes research budgets over the next 5 years.

The recent actions of the committee that Senator Gregg already alluded to direct $454 million, including a nearly $206 million increase, to support a number of the Commission's programatic recommendations within NOAA, is a tremendous first step toward implementing the Commission's overall science investment recommendation and we thank you heartily for that tremendous effort.

Now, the Commission identified many areas where additional investments in scientific research and education should lead to measurable improvements in the way we manage and utilize our ocean and coastal resources.

I have got a long list of those in my written testimony, and that doesn't cover all of them, but I am only going to hit on a few today of particular interest to me; that is one of the perks of being able

to give the testimony is I get to choose, like Bob did, those items that interest me.

Beginning with education: Support for a comprehensive, national ocean education program that would go from "K-to-gray" pervades the entire Commission report. To develop and implement such a program, the Commission recommends establishment of a national Ocean Education Office; tripling the numbers of Centers for Ocean Science Education Excellence in the country; improving K through 12 ocean education activities; supporting more interaction between scholars and educators to build teacher capacity between scholars, researchers and educators, something that would be a big deal in this kind of campus environment; expanding scholarships for undergraduate, graduate and postdoctoral students and supporting informal education activities delivering the consistent message at aquaria, museums and zoos across the country.

In addition, the Commission recognized the strengths of the National Sea Grant college program in ocean education and recommended substantial enhancement to that program. Overall, the Commission estimated ocean education funding needs at $25 million in new money in the first year, growing to $136 million annually thereafter. And we are grateful that the committee seems to share our enthusiasm for improving ocean literacy, as evidenced by your recommendations for notable new investments in these areas.

Moving to the observing system. None of us today could or want to imagine a world where we would have to live without constantly updated weather reports and forecasts. In light of the very recent and ongoing hurricane threats and impacts in the southern United States, where I live—and I checked before going to bed last night and first thing this morning to see where Jeanne was—the need for an Integrated Ocean Observing System, or IOOS, is in very real terms a matter of life and death.

The observing system would measurably improve our abilities to protect human life and property from marine hazards, including not only the storms and floods that we are dealing with now, but also such things as harmful algal blooms, concentrations of disease-causing microorganisms or toxic chemicals.

The observing systems could also substantially aid homeland security efforts and provide a wealth of useful information to businesses, academic researchers and ordinary citizens across the country.

The observing system should be built upon a foundation of strong and diverse partnerships and be planned under the auspices of something called Ocean.US, an interagency coordinating arm of that National Ocean Council.

NOAA should be the lead Federal agency for the observing system, but should work through Ocean.US to integrate the observing system across all agencies and ensure that the country ends up with one national observing system, not a whole bunch of unrelated systems.

The price for implementing the observing system is considerable, beginning with an investment of $231 million a year and growing to $753 million annually in new funding. However, the economic and social costs of not building and implementing the observing system are probably incalculable. Again, we heartily thank the

committee for supporting substantial investment in NOAA for integrated coastal and ocean observations.

The area of living marine resources: The status of the Nation's fisheries was a topic of concern that we heard about at every single one of our meetings. As a result, the Commission devoted a lot of attention to fisheries, focusing largely on ways to improve the regional fishery management councils and Federal, regional and State management processes.

Our recommendations deal with strengthening and separating scientific and allocation decisions; clarifying jurisdiction; improving public representation; expanding the use of dedicated access privileges and reducing overcapitalization; improving enforcement; dealing with bycatch and essential fish habitat from ecosystem approaches; and strengthening international management.

The Commission recommends increases in funding for fisheries management at $29 million for year one, growing to $88 million annually for following years, with additional funding for ecosystem science to support fisheries management as part of the overall doubling of the Federal ocean science budget. And again, we thank the committee for its support for improved fisheries management.

Now, indicative of the growing problem of human impacts on coastal waters are the increasing frequencies of beach closures, seafood consumption advisories, harmful algal blooms and occurrences of toxic chemicals and pathogenic microorganisms in coastal and even offshore environments, all of which in turn result in increasing cases of human illness.

On the other hand, the oceans represent the greatest global reservoir of biodiversity, with huge and mostly unexplored potential for production of pharmaceuticals and other bioproducts that could measurably improve human existence and produce billions of dollars annually in new business revenues.

The Commission therefore proposes a national, multiagency oceans and human health initiative and doubling of current funding levels for this critical effort. And again, we thank the committee for doing just that, recommending doubling of NOAA's oceans and human health initiative from $10 to $20 million a year.

Numerous factors impact populations of marine mammals, sea turtles, corals and other endangered and vulnerable marine species, including bycatch in directed fisheries, hunting, loss of breeding, nesting and foraging areas, ship strikes, pollution, disease, and the list goes on.

Unfortunately, little is known about the relative importance or cumulative impacts of such factors on the survival, and especially the recovery, of most protected species. So the Commission has recommended that NOAA and other relevant Federal agencies expand their work on marine mammals, sea turtles, corals and other vulnerable species, specifically to get a better understanding of basic biology and population dynamics and how disease, contaminants, harmful algal blooms and other human activities impact these and how we can best respond to strandings and unusual mortality events.

The Commission has recommended increasing funding by $17 million a year, initially, with sustained funding of $26 million over the fiscal year 2004 level. And we applaud the recent action of this

committee to increase funding by $12 million for a NOAA marine mammal initiative to deal with some of these issues.

The final issue I want to mention is aquaculture. The Commission has recommended that NOAA become the lead for offshore marine aquaculture and that an Office of Sustainable Marine Aquaculture be established within NOAA to deal with both the policy issues and the environmental concerns that affect marine aquaculture development.

In conclusion, Mr. Chairman, the Commission devoted a great deal of attention to science and education within NOAA and we recognize that today's NOAA simply does not have the resources nor the stature to do the job that tomorrow's ocean demands.

To lead the Nation toward an ecosystem-based approach to management of coastal, ocean and Great Lakes resources as the Commission envisioned, NOAA must have the organizational structure, agency stature and authorities necessary to provide that leadership and to effectuate change; it must become more partner and service oriented; and it absolutely must have the necessary financial resources to do the job that the Nation so desperately needs it to do.

PREPARED STATEMENT

Thank you, Senator Gregg, for your continuing high level of interest in and support for the activities of the Commission and especially for the outstanding efforts of this committee to put NOAA well on its way to gaining the funding required to implement many of the Commission's recommendations. Thank you, sir.

Senator GREGG. Thank you very much, Doctor. We very much appreciate your thoughts and input and the great work you have done relative to the Commission.

[The statement follows:]

PREPARED STATEMENT OF PAUL A. SANDIFER

INTRODUCTION

Mr. Chairman and members of the Committee. My name is Paul Sandifer, and I thank you for the opportunity to testify before you today on behalf of the U.S. Commission on Ocean Policy, along with my colleagues and fellow Commissioners, Drs. Andrew Rosenberg and Robert Ballard.

When I was appointed to the Commission in 2001, I was Director of the South Carolina Department of Natural Resources (SCDNR) and the only state official to serve as a Commissioner. In April of 2003, I retired from the SCDNR and joined NOAA as Senior Scientist within the National Ocean Service's National Centers for Coastal Ocean Science. Please note that I am appearing today solely in my capacity as a member of the U.S. Commission on Ocean Policy and that my testimony is based on recommendations from our Final Report which was submitted to the Administration and the Congress just one week ago on September 20, 2004.

Without doubt, the highlight of my professional life has been my service on the U.S. Commission on Ocean Policy. It has been an immensely rewarding and educational experience, and I believe that the Commission has crafted many well-thought-out recommendations for the improvement of ocean policy in this country. In my opinion, we are at a truly pivotal point of human life on this planet. Simply put, the oceans make Earth habitable for humans, yet we are in the process of disturbing, dismantling, and even poisoning this life engine. As my colleague, Dr. Rosenberg, has so eloquently stated, our ocean environment is truly at risk, and we must change course to reduce that risk and maintain a vibrant marine environment and its untold economic and environmental benefits to society.

Rather than focusing on just the alarming trends, the Commission began its work by envisioning a better future for our oceans, coasts and Great Lakes. Early in our deliberations, we established a series of 13 overarching principles to guide our work. Based on these principles and detailed evaluations of the myriad problems and op-

portunities associated with the nation's ocean, coastal and Great Lakes environments, the Commission focused on four foundation blocks that we deemed essential for a new and comprehensive national ocean policy. These are:

(1) *Improved governance*.—The Commission believes that little progress will be made unless we first fix the way we do business in the marine environment, moving from an agency-by-agency or smokestack-by-smokestack approach to a much more coordinated, interrelated and comprehensive ocean governance structure. As Dr. Rosenberg has pointed out, this entails creation of an ocean policy framework at the national level and substantial strengthening of and changes to NOAA, the nation's lead civilian ocean agency.

(2) *Ecosystem-based approach to management*.—The centerpiece of the Commission's recommendations for management of U.S. coastal and ocean resources is that they be managed to reflect the relationships among all ecosystem components, including humans and nonhuman species and the environments in which they live and that eco-regional management areas be defined based on ecosystem, rather than political, boundaries.

(3) *Best available science*.—Ocean policy decisions should be based on the best available understanding of the natural, social, and economic processes that affect ocean and coastal environments. Substantial and carefully targeted new investments are absolutely essential to provide the science foundation for improved decision-making.

(4) *Broad public education*.—Studies show that integrating ocean topics into curricula can boost student motivation, scientific literacy, and overall achievement. Increasing formal and informal educational opportunities will also result in greater public awareness and a stronger stewardship ethic for our ocean and coastal resources.

Dr. Rosenberg has already talked about the first two of these foundation blocks, governance and ecosystem-based management. I would like to focus my testimony on science and education.

The key element necessary to foster a new era of science- and ecosystem-based management of ocean and coastal resources is significant new investment in ocean-related natural and social sciences. Despite the extraordinary efforts and leadership of this Committee—for which everyone in the greater ocean community is truly grateful—ocean science is still woefully underfunded, especially in light of the increasing demands for more and better scientific information and advice to deal with homeland security and defense issues, declining natural resources, emerging health threats and many other problems.

Recognizing the absolute necessity for greater investment in ocean-related science, the Commission recommends a doubling of the federal ocean, coastal and Great Lakes research budgets over the next five years. Such investments are absolutely essential if the United States is to be able to assess and predict the status of marine resources; find beneficial new uses of ocean resources such as bioproducts, pharmaceuticals and aquaculture; restore fisheries and rebuild a vibrant fishery economy and fishery communities; grow coastal tourism while protecting those natural attributes of clean water and functioning habitats that make our coasts such attractive places to recreate, live and work; and the list goes on and on. The recent actions of this Committee to direct $454 million, including a nearly $206 million increase, to support a number of the Commission's programmatic recommendations is a tremendous first step toward implementing the Commission's proposal for a doubling of federal ocean science expenditures over a five-year period. Thank you very much for your magnificent support for the Commission's work and most especially for caring so deeply about the future of our coastal, ocean and Great Lakes resources and environments.

Now, the Commission identified a number of very specific areas where additional investments in scientific research should lead to measurable improvements in the way we manage and utilize our ocean and coastal resources and the actual status of those resources. I've listed these in alphabetical order just for ease of presentation, as follows:

The Commission identified a substantial list of specific areas where additional investments in scientific research should lead to measurable improvements in the way we manage and utilize our ocean and coastal resources and the actual status of those resources including such diverse topics as biodiversity, climate change, and water pollution. I have listed more than 20 of these below.

Biodiversity
Climate Change
Coastal Habitat
Coastal Hazards
Coastal Monitoring
Coral Communities
Ecosystem Science
Fisheries

Integrated Ocean Observing System	Oceans and Human Health
International Science	Regional Assessments
Invasive Species	Scientific Infrastructure (labs, ships, submersibles, equipment)
Mapping and Charting	
Marine Aquaculture	Sediments
Marine Debris	Socioeconomic Science
Marine Mammals and Protected Species	Water Pollution
Ocean Education	Weather Services

There is simply no way to do justice to such a list today, so I've chosen to concentrate on just several of particular importance and personal interest to me. These are: (1) ocean education and literacy; (2) the Integrated Ocean Observing System; (3) sustainable fisheries; (4) the interactions of oceans and human health; (5) conservation of marine mammals, sea turtles and other vulnerable species; and (6) marine aquaculture.

Ocean Education

The oceans hugely influence the daily life of people across the country, regardless of whether they live in coastal or inland communities. In fact, in the view of the Commission, the United States is an island nation and all its states are coastal states. Development of an ocean stewardship ethic among the public at large is essential for the long-term conservation and sustainable use of ocean, coastal and Great Lakes resources. Perhaps because of the close connection between humans and the oceans over our entire evolution, ocean topics have the unique ability to engage students and hold their interest so that a host of scientific and mathematical concepts can be communicated. Ocean-based studies can also enhance student performance in areas beyond the natural sciences, such as geography, history, economics, law, and literature.

Support for a comprehensive, national ocean education program that would go from "K-to-gray," that is, from kindergarten through primary and secondary school, college, graduate and post-graduate school and lifelong informal learning activities pervades the entire Commission report. Among many activities, the Commission noted two national-level ocean education programs of particular value: the Centers for Ocean Science Education Excellence (COSEE) supported by NSF with additional funding from the Office of Naval Research and NOAA, and NOAA's National Sea Grant College Program. In addition, the wealth of U.S. aquariums, zoos, museums, and other informal education centers also provide the public with diverse opportunities to learn about the marine environment.

The problem with ocean education in the United States is not a lack of interest but more a lack of resources and especially a coordinated, sustained, comprehensive ocean education program. Instead, we have what the Commission describes as "a patchwork of independently conceived and implemented programs and activities" that cannot provide the nationwide momentum and visibility needed to promote sustained ocean education for students, teachers, and the general public.

Without leadership, no common vision for ocean education will be developed and no path for achieving such a vision will be laid out. Thus, the Commission recommends several steps, beginning with establishment of a national Ocean Education Office funded through NOAA's budget within an enhanced National Oceanographic Partnership Program. In addition, the Commission outlined other essential leadership roles for NOAA, particularly at the college and graduate school levels. Overall funding needs for ocean education activities are estimated by the Commission to be $25 million above fiscal year 2004 levels in year 1, growing to $136 million in ongoing new annual appropriations. Funding at these levels would allow for: establishment of the Ocean Education office; strengthening of ocean education activities within NOAA, NSF, NASA, and ONR; tripling the number of COSEE centers; evaluation and improvements in K–12 ocean education programs; supporting close interaction between researchers and teachers to enhance teacher capacity; substantially expanded scholarship support for undergraduate, graduate and post-doctoral students to ensure the appropriate training of new generations of ocean scientists; and support for informal education experiences that can reach millions on a daily basis. In addition, the National Sea Grant Program, and its education and outreach efforts, should be enhanced as part of the doubling of the U.S. ocean research budget. Sea Grant has an excellent track record of providing teacher preparation and professional development programs consistent with state education standards and of offering hands-on educational experiences for students and teachers. The Commission recognized the strengths of the Sea Grant program and its long-standing partnerships at the state and local level, and recommended that the Sea Grant program not only receive higher funding, but also devote a greater pro-

portion of its resources to ocean education. The enhancements to the Sea Grant program's educational portfolio would come from these increases and would be in addition to the sums identified above. We are grateful that the Committee shares our enthusiasm for improving ocean literacy, and has already recommended specific and significant new investments in these important programs.

Integrated Ocean Observing System

Beginning about 150 years ago, the United States began building what is now the most comprehensive weather forecasting and warning network in the world. Today, none of us could or want to imagine a world where we would have to live without constantly updated weather reports. In light of the very recent and ongoing hurricane threats and storm-related impacts in the southern United States where I live, the need for such a system—and for substantial improvements in understanding weather, climate, and a broad range of ocean responses that affect both coastal and inland communities—is in very real terms a matter of life and death.

The Integrated Ocean Observing System would augment physical observations and measurably improve our abilities to protect human life and property from marine hazards, including not only storms and flooding events, but also such things as harmful algal blooms and threatening pollution concentrations. One particular effort ongoing with the observing system network in the South Atlantic where I work is the development of significantly enhanced ability to predict storm surge and flooding, both of which contribute to more deaths and injuries than do the high winds of hurricanes and tropical storms. This is but one potential utility of the observing system. Others uses are as diverse as:

—augmenting national defense and homeland security;
—understanding human-induced and natural changes in the environment and relations between them and predicting effects on humans;
—tracking and understanding climate change and the ocean's role in it; and
—supplying important information to ocean-related businesses, marine transportation industry, fishers and fishery managers, and others.

An integrated ocean observing system that is regionally, nationally and internationally connected and coordinated can serve the nation much better than the 40+ coastal ocean observing systems now in various stages of development and operation. These make important contributions, but the greatest value is in the synergy that will come from fully linking them together into a comprehensive network. In this regard the U.S. Commission on Ocean Policy recommends that the IOOS be a key element of a new ocean program, building upon strong partnerships among federal, state, territorial, tribal and local governments, non-governmental organizations, industry, and academia. The IOOS should be planned under the auspices of Ocean.US, which would be the interagency coordinating arm for the observing system under the National Ocean Council that Dr. Rosenberg briefly described. NOAA should serve as the lead federal agency for implementing and operating the IOOS. NOAA's role should be to work through Ocean.US to integrate the observing system across all agencies, ensuring that the nation ends up with one national observing system, not a NOAA system, a Navy system and an NSF system, or a whole bunch of unconnected systems serving different needs.

The success of IOOS will also depend on its drawing upon a broad constituency and meeting the needs of numerous users, including the general public. This will require that it: reach out to many groups, especially those outside academia; develop a set of core variables to be measured throughout the system, along with sufficient flexibility to deal with differing regional priorities and situations; include fisheries, protected species and other biological data and chemical as well as physical parameters; and establish a process for migrating from research to operational modes as quickly and seamlessly as possible.

The price for implementing the IOOS is considerable—beginning with $231 million in additional funds in year 1 and growing to a sustained level of $753 million in new funding. However, the cost of not building and implementing IOOS in terms of economic and other impacts on U.S. society is probably incalculable. Again, we heartily thank the Committee for supporting this crucial initiative and making such a substantial investment in NOAA to support coastal and ocean observations.

Sustainable Fisheries

The status of the nation's fisheries was a topic we heard about at every one of our meetings. It is something that people across the country and from every walk of life are concerned about, and nowhere was the need for an ecosystem-based management approach more evident than with regard to fisheries. As a result, 27 of our 212 recommendations deal directly with fishery issues, and numerous more would

affect fisheries indirectly. No other single issue received this much attention by the Commission.

Because the Regional Fishery Management Council structure contains so many of the characteristics that the Commission believes are important as a foundation for ecosystem-based management, the Commission did not focus on wholesale changes to the Councils but chose instead to recommend substantial strengthening of the Councils, and federal and state management processes in six major areas: (1) strengthening the link between science and management by separating scientific and allocation decisions; (2) clarifying jurisdiction and increasing public representation; (3) expanding the use of dedicated access privileges and decreasing overcapitalization; (4) improving enforcement; (5) dealing with bycatch and essential fish habitat; and (6) strengthening international management. In particular, the Commission found that: "The role of scientific information should be as strong as possible in fishery management and subject to the least possible political influence."

The Commission recommends increases in funding for fisheries management at $29 million for year 1 and approximately $88 million for following years. These new funds would support such activities as expanded work by the Scientific and Statistical Committees of the Councils; growth of cooperative fisheries research with participating fishermen and others; increased joint enforcement agreements with states to improve enforcement; development and implementation of improved regional bycatch plans; a more ecosystem approach to essential fish habitat designations; and other efforts to enhance the work of the fisheries management councils and the interstate fishery commissions. Additional funding for ecosystem science to support fisheries management at federal, regional and state levels should also be part of the overall doubling of the federal ocean science budget. Further and very importantly, fisheries science needs to be part of the more integrated national science program dealing with ecosystems. As the Commission points out, we need an overall science plan for ecosystem-based management, and we need data and information management systems that will help ensure delivery of the best available scientific information to fishery managers, coastal managers, and others at federal, regional, state, tribal and local levels. Once again, the actions of this Committee to support improved understanding and management of fisheries are truly remarkable, and we thank you for them.

Oceans and Human Health

Estuarine and coastal processes are being impacted by humans through urban and agricultural runoff, sewage discharges, deposition of airborne pollutants, industrial waste streams, shoreline modifications, wetland dredging and filling, overfishing, introduction of invasive species, habitat destruction, high density recreational use, climate change, and other pathways. Indicative of the growing problem are the increasing frequencies of beach closures, seafood consumption advisories, harmful algal blooms, and occurrences of toxic chemicals and pathogenic microorganisms in coastal and even offshore waters, sediments and biota. These negative human effects on marine ecosystems in turn result in increasing cases of human illness and other impacts on human well being.

On the other hand, the oceans represent the greatest global reservoir of biodiversity, with huge and mostly unexplored potential for production of bioproducts that could measurably improve human existence. From these natural products, a broad range of useful materials could be developed, including pharmaceuticals, nutritional supplements, medical diagnostics, pesticides and herbicides for agricultural applications, enzymes and chemical products for disease research, and many others. The potential annual value of each class of these marine-derived bioproducts may be in the multi-billion dollar range.

Based on both such opportunities and the need to understand and mitigate the increasing risks to humans from coastal and marine exposures, the Commission recommends several actions, including: (1) the establishment of a national, multi-agency Oceans and Human Health Initiative involving NOAA, NSF and NIEHS to sponsor and coordinate exploration, research, and development of new technologies related to the various connections between the health of coastal, ocean and Great Lakes ecosystems and human health; (2) expanded research related to the complex inter-relations of pollution, harmful algal blooms, emerging marine diseases, ecosystem degradation, climate change, and microorganisms and their effects on health of marine organisms and humans; (3) development of practical natural compounds from marine organisms; and (4) improved programs to ensure seafood safety and coastal water quality.

To carry out these functions, the Commission recommends doubling of current funding levels for this critical initiative. We salute the Committee for its recommendation to do just that—increase funding for the NOAA Oceans and Human

Health Program from $10 to $20 million, and again we thank you for your tremendous support.

Marine Mammals and Endangered Species

Numerous factors impact populations of marine mammals, sea turtles, corals, and other endangered and vulnerable marine species, including bycatch in directed fisheries, hunting, loss of breeding, nesting and foraging habitat, ship strikes, pollution, and disease. Unfortunately, little is known about the relative importance or cumulative effects of such factors on the survival and especially the potential for recovery of most protected species. Yet, today the nation must cope with unprecedented and increasing incidences of unexplained mass mortalities of marine mammals, regional and global epizootics, increasing discovery of marine animal diseases that are shared with humans or terrestrial animals, continuing and accelerating declines of populations of sea turtles and other marine animals, and a substantial and increasing scope of disease threats to marine populations. As pointed out by the Commission: "The lack of baseline biological data on most marine mammals and endangered species, coupled with limited stock assessment data, make it difficult to evaluate population abundance and trends, isolate causes of mortality, or distinguish management successes from failures."

In response to public concerns about the growing numbers of dead and dying marine mammals washing up on our shores, in the late 1980s NOAA established a Marine Mammal Health and Stranding Response Program. Even with rather limited resources, NOAA and its partners and extensive volunteer network have responded to stranding events encompassing a wide range of species and numerous causative factors, including diseases, starvation, toxins from harmful algal blooms, and human interactions. However, the causes of a substantial portion of these events are as yet undetermined, and the potential risks to humans are largely unknown. No similar federal program exists for other marine organisms like sea turtles or fish, such as the croakers that are dying off in droves now in mid-Atlantic states.

The plight of marine mammals, sea turtles, corals, and many other marine organisms threatened by unexplained and unknown diseases and poor health suggests that the marine environment holds increasing threats to a variety of biota, including the human populations that are flocking to our coasts. There is a significant need for a multi-disciplinary approach to examine the health of marine animal populations in coordination with the emerging integrated ocean observing system and the oceans and human health initiatives mentioned above.

Thus, the Commission recommends that NOAA and other relevant federal agencies undertake an expanded research program on marine mammals, sea turtles, and other protected species populations and then use this information for more comprehensive, ecosystem-based management and more effective permitting procedures. Specifically, this research initiative should focus on:

—better understanding of the basic biology, physiology, life history, and population dynamics of marine mammals, sea turtles, and other endangered or vulnerable marine species and how disease, contaminants, harmful algal blooms, human activities, and other stressors may impact these animals;

—enhanced capability to respond quickly to strandings and unusual mortality events involving marine mammals and sea turtles;

—the effect of sound on marine mammals; and

—development of technology to eliminate or mitigate human impacts on marine mammals, sea turtles, and other endangered species.

In these areas, integrated, interagency programs will be essential, especially in dealing with thorny issues such as the effects of noise on mammal populations. The Commission recommends increasing funding by $17 million/year initially with sustained additional funding of $26 million/year over fiscal year 2004 levels, with some additional funding for research in these areas as part of the overall doubling of the federal ocean science budget. The Commission applauds recent action of this Committee to provide $12 million for a marine mammal initiative to deal with many of the problems noted above.

Marine Aquaculture

The Commission concluded that sustainable marine aquaculture has potential to become a significant industry in the United States and a means of reducing the nation's annual $7 billion seafood trade deficit if developed properly. However, for offshore marine aquaculture to develop in the United States, three major problem areas must be dealt with: environmental issues must be addressed; a predictable regulatory framework must be put in place; and new technologies must be developed.

Recognizing both the potential benefits and the possible negative environmental impacts associated with marine aquaculture, the Commission recommends that: (1) NOAA be designated the lead federal agency for marine aquaculture; (2) an Office of Sustainable Marine Aquaculture be established in NOAA with responsibility for developing—in consultation with states, other federal agencies and interested parties—a comprehensive, environmentally-sound permitting, leasing, and regulatory program for marine aquaculture and expanding marine aquaculture research, development, training, extension, and technology transfer activities; and (3) the United States should work internationally to encourage global adherence to responsible aquaculture practices.

Comprehensive marine aquaculture legislation that sets clear goals, authorities and responsibilities and ensures that aquaculture is placed within an ecosystem-based ocean management framework will likely be necessary.

To accomplish these activities will require a minimum of $3 million in new funding in the first year, growing to $7 million annually thereafter and augmented by additional research funds through Sea Grant and other NOAA and federal-agency research budgets.

CONCLUSION

The Commission considers structural improvements in ocean governance, an ecosystem-based approach to ocean and coastal resource management, substantially increased investment in scientific research to underpin management decision-making, and improved ocean literacy to be essential foundation blocks for a comprehensive and sustainable national ocean policy for the United States. In its deliberations, it devoted a great deal of attention to NOAA and considers the agency a crucial player in all four of these key areas.

While recognizing the central importance of NOAA, the Commission also is cognizant of its many limitations as it is presently organized, operated and supported. In place of the "old" NOAA, the Commission envisioned a "new NOAA" that would be "a stronger, more effective, science-based and service-oriented ocean agency—one that contributes to better management of oceans and coasts through an ecosystem-based approach . . ." Today's NOAA simply does not have the resources or the stature to do the job that tomorrow's oceans demand. To lead the nation toward an ecosystem-based approach to management of coastal, ocean and Great Lakes resources as the Commission envisioned, NOAA must have the organizational structure, agency stature and authorities necessary to provide that leadership and effectuate change; it must become more partner and service oriented; and it absolutely must have the necessary financial resources to do the job that the nation so desperately needs it to do.

Thank you for holding this hearing and for the continuing high level of interest in and support for the activities of the U.S. Commission on Ocean Policy. The Commission worked diligently to provide practical, workable recommendations for improvements to the overall U.S. ocean policy and to a host of management, research, educational, operational, and international activities. If enacted, the Commission's recommendations will lead to healthy ocean, coastal and Great Lakes resources that can sustain us, our children, and their children's children and provide a literal treasure-trove of economic benefits to the nation. Thanks to the outstanding work of this Committee, NOAA is well on its way to gaining a very significant portion of the funding required to implement many of the Commission's recommendations. Again, we thank you for this marvelous support, and I thank you for the opportunity to speak before you today.

I would be pleased to respond to any questions you may have.

Senator GREGG. I note that in the audience, we are joined by Dr. Berrien Moore, who has spent a lot of time in Washington recently and is doing a fabulous job of trying to give us some thoughts and direction for the NOAA research effort overall. And we certainly appreciate his support and his leadership; tremendous resource, obviously, here at UNH.

Now, Dr. Rosenberg, we would like to get your input, thoughts and guidance and concerns.

STATEMENT OF ANDREW A. ROSENBERG, Ph.D., MEMBER, U.S. COMMISSION ON OCEAN POLICY; AND PROFESSOR, UNIVERSITY OF NEW HAMPSHIRE

Mr. ROSENBERG. Thank you very much, Senator, and to the committee for holding this hearing. And I would particularly like to thank you for your leadership on the Oceans Act of 2000, continuing leadership on new legislation with regard to ocean policy and for the opportunity that I have had to serve on the Commission. Plus, I would like to thank the university for the opportunity to spend 3 years working on the Commission.

It really has been an honor to work with an extraordinary group of fellow commissioners, including most notably Paul Sandifer, to my left, and the man who used to be known as Jacques Cousteau, but is now Robert Ballard on my right. They really are an extraordinary group of people and it has been a lifetime educational opportunity for me, which I am very grateful for.

I believe that our recommendations truly meet the spirit and intent of the Oceans Act. And our ocean environment is at risk, as the Commission points out and as I certainly believe. And the Nation really does need to make policy changes to reduce that risk.

As you noted, Senator, some of the students here are in an ocean policy seminar course that I am teaching, graduate course that I am teaching this semester and are going through the report. And I hope they will have an opportunity to comment on and review all of the recommendations.

One of the interesting things that happened to me in the course of the Commission work was one reporter asked me about the former Ocean Policy Commission, the Stratton Commission and said, well, this U.S. Commission on Ocean Policy is the first commission in 35 years. I said yes, that is correct. The reporter said, "Did you serve on the other commission as well?" And my response was, "no, I didn't. I was 12 at the time and my dad wouldn't let me."

But I think the important part here is that hopefully some of the now students and soon to be leaders, nationally and in some cases internationally, in the room, may have an opportunity to review our work 20 or 30 years from now and I hope they have good things to say about it, as we do about the Stratton Commission.

My comments this morning will focus on two areas, the governance structure we use for implementing ocean policy and the adoption of the principle of ecosystem-based management for the oceans.

Please note that I offer the Commission recommendations as well as my personal opinion in these comments and I have tried to be careful in distinguishing between them.

The Commission recommends four components for a new governance framework to implement ocean policy: National coordination and leadership; a strengthening and streamlining of the Federal agency structure; a development of regional solutions to national problems; and the establishment of a coordinated offshore management regime.

In my opinion, these four elements should be included in a National Ocean Policy Act that also specifically sets national goals for managing our ocean and coastal areas and helps knit together the

extensive and often confusing framework of statutory mandates and policy direction we now have. So these goals should be based on the guiding principles in the report of the Commission.

The Commission found that Federal level coordination and leadership is fragmented at best and inconsistent in too many cases. The Commission calls for a National Ocean Council to coordinate across the agency and that Council can help resolve conflicting mandates, improve the leverage of those programs in various agencies, the leverage they can obtain from one another, as well as provide more coherent leadership for the Nation on ocean policy.

And I should note here, I worked for NOAA for 10 years and have enormous respect for the agency and for the other Federal agencies. They have incredibly talented employees and work extremely hard, but they need some additional tools in order to do what they need to do.

I think the Ocean Council must do more than just oversee ongoing activities. The Council must have the authority to make real change in ocean governance. The Commission recommends a stronger NOAA as the lead ocean science and management agency for the Nation. And in my view, NOAA has remained a collection of agencies rather than a coherent lead ocean agency.

The National Ocean Policy Act should strengthen NOAA by drawing programs together from across the Government to reduce program fragmentation. And as new imperatives come forward, such as the implementation of an Integrated Ocean Observing System that Dr. Sandifer mentioned or the implementation of a ecosystem-based approach to management, which I will discuss further, NOAA must grow into these programs in stride.

NOAA must remain a science-based agency as one of its core attributes. Prediction, monitoring and management functions rely on science and research, the science and research enterprise of NOAA and its external partners, such as UNH and many other universities.

As a former NOAA scientist, a NOAA Regional Administrator and then recently a member of the NOAA research review team that Dr. Moore chaired, I strongly believe that research and the provision of science advice for management and operations must remain together. The linkage between science and management needs to be strong enough to ensure that science advice of the highest quality is available on a timely basis to policymakers and managers. To put it bluntly, researchers can't refuse a call for science advice because they are more interested in something else because we rely on that science advice critically to make management decisions. That means that as NOAA continues to evolve, separating off research, our very best scientists from the advisory function is a difficult challenge that we have to address. And I believe we must keep the advisory function and the research functions together.

Overall I believe there are a couple of clear options for NOAA, including restructuring the agency into three lines based on core functions or possibly based along mission lines. The core functions being ecosystem-based management; operations and prediction services; and scientific advice, research and education. Or the mission lines, coastal and marine ecosystem services; weather and climate services; and research, operations and data services.

The budget must, of course, then follow the structure and allow programs to be streamlined and consolidated.

And in my opinion, the end result may be that the stronger and bigger NOAA logically becomes an independent agency, but that decision must wait to see the shape of that agency to come.

The Commission recommends that we adopt the principle of ecosystem-based management, that is managing human activities within a large marine ecosystem in concert rather than separately, considering the cumulative impacts of those activities on the functioning of the ecosystem as a whole.

For example, coastal development interacts with the pollution abatement programs and affects fisheries productivity in the coastal ocean and salt marshes and nearshore areas, such as along the New Hampshire coast.

In order to implement ecosystem-based management, five changes are needed: Creating regional councils and information management systems; developing the capability for the Federal Government to manage on an ecosystem basis; structuring science programs to support ecosystem-based management; having an overall set of policy goals to guide the process; and developing a comprehensive offshore management regime to deal with gaps in the current management authorities.

Regional councils must be developed in order to plan and coordinate across various sectors of human activities that impact the ecosystem. The Commission recommends setting up regional pilot programs where each region may choose the issues it begins work on; that flexibility is essential.

Finally, there are major gaps in the current set of authority for management, particularly in offshore waters. There is no real governance structure for newly emerging activities, such as energy production, aquaculture and bioprospecting to name a few. Without an overarching policy framework that sets goals for ecosystem-based management, ensures that analysis considers impacts across sectors, specifically sets criteria for deciding protection and access privileges, development will be poorly managed.

Senator, and to your committee in general, I thank you for the opportunity to testify today and particularly for your holding this hearing in New Hampshire. I have only touched on a few of the important issues in the Commission report. I was intending on going through all 212, but thought that perhaps that might go a little long.

PREPARED STATEMENT

I do recommend that we look across that set of issues, and as your committee and the Commerce Committee has already done, begin to focus on the broad scale picture as quickly as possible, because I think there is no time to waste in terms of protecting the ocean. Thank you very much.

Senator GREGG. Thank you, Doctor. And I presume your graduate students here took many notes and will be paraphrasing that statement back to you to assure the A that they deserve.

[The statement follows:]

PREPARED STATEMENT OF ANDREW A. ROSENBERG

Mr. Chairman and members of the Committee: Thank you for the opportunity to testify before you today concerning the future of U.S. ocean policy. I am Andrew Rosenberg, a member of the U.S. Commission on Ocean Policy and a Professor of Natural Resources in the Institute for the Study of Earth, Oceans and Space at the University of New Hampshire.

The Ocean's Act of 2000 formed the U.S. Commission on Ocean Policy and directed us to "make recommendations for coordinated and comprehensive national ocean policy . . ." The Act set out eight specific objectives for this policy paraphrased here: (1) protection of life and property; (2) responsible stewardship of ocean and coastal resources; (3) protection of the marine environment; (4) enhancement of marine-related commerce, resolution of conflicts among diverse users of the marine environment and engagement of the private sector in developing approaches to the responsible use of marine resources; (5) expansion of knowledge of the marine environment and the advancement of education in fields related to the ocean and coasts; (6) development and improvement in technological capability for ocean related activities; (7) cooperation among all government agencies to ensure coherent regulations, appropriate use of funding, efficient operation of federal agencies, and enhancement of partnerships with state and local governments; and (8) leadership by the United States in ocean and coastal activities.

My participation as a Commissioner is an honor and a once in a lifetime educational opportunity for which I am very grateful. I believe our recommendations truly meet the spirit and intent of the Oceans Act. Further, I believe that we must immediately begin to make changes in U.S. ocean policy to reverse an alarming, widespread degradation in the health of the oceans and coasts, vital living marine resources, coastal communities, leadership in ocean science and the life-support system of the earth. While this may sound dramatic, I believe that our ocean environment is at risk and a change of course is needed to reduce that risk.

In this testimony I wish to focus on two overarching themes of the Commission report; the governance structure we use for managing our activities and impacts on the ocean and the adoption of the principle of ecosystem-based management for the oceans. My colleagues, Drs. Sandifer and Ballard, will be addressing other aspects of the report for the Committee.

The Commission recommends four components for a new governance framework to implement Ocean Policy: (1) national coordination and leadership, including (2) a strengthened and streamlined federal agency structure, (3) the development of regional solutions to national problems, and (4) the establishment of a coordinated offshore management regime. In my opinion, these four elements should be included in a National Ocean Policy Act that also specifically sets national goals for managing our ocean and coastal activities and helps knit together the extensive often confusing framework of statutory mandates and policy direction we now have. These national goals should be based on the guiding principles in the report of the Commission. In particular, I would like to highlight: stewardship, resources are held in the public trust for all Americans; ecosystem-based management, understanding and mitigating the cumulative impacts of human activities on the ecosystem as a whole; adaptive management, continuously re-evaluating management as new information becomes available and making adjustments as needed to meet the goals; understandable, clear rules, making the rules that govern various activities coherent for the public; accountability, to ensure that government and the public do what is needed to conserve marine ecosystems; and international responsibility, working cooperatively on ocean issues and meeting our responsibilities for global ocean policy. Using these and the other principles an overarching ocean policy can be articulated for the nation.

The Commission found that federal level coordination and leadership is fragmented at best and inconsistent in too many cases. In my opinion, agencies are working hard to meet their mandates. I had the privilege of working for NOAA for ten years, and served as Deputy Director of the National Marine Fisheries Service. The NOAA personnel are talented and dedicated but they don't have all the tools they need to do the job. Nor do they have an overarching framework for all of the conflicting mandates that the various statutes and demands of the day bring. The Commission calls for a National Ocean Council to coordinate across the agencies. The Council can help resolve conflicting mandates, improve the leverage that programs can obtain from one another, and present a more coherent leadership for the nation on ocean policy. The Council should be chaired by an Assistant to the President for Ocean Policy, not by any one agency head. The goal of the Council should be to work toward a coherent national policy with regard to management, science and education, with agencies working together, not in opposition to one another.

While Councils may seem just another layer of bureaucracy, I think this Ocean Council must do much more than just oversee ongoing activities. Its mandate, following on from the Oceans Act mandate to the Commission, should be to implement a more coherent and efficient national governance system. The starting point for the Council should be planning and coordinating the implementation of the Commission's recommendations. Somewhat analogous to current discussions in the intelligence realm, the Council must have the authority to make real change in ocean governance through the budget process, resolving conflicting mandates and streamlining of programs across the federal government. However, note that it will still be the agencies that have responsibility for implementing specific actions to address mandates. The Council serves as a planning, coordinating and conflict resolution body for the implementing agencies, as well as a monitor for progress toward national goals.

The Commission recommends a stronger NOAA as the lead ocean science and management policy agency for the nation. We recognize that many ocean related activities are going to remain in various agencies across the government and the National Ocean Council will need to coordinate between these agencies. NOAA was created in response to the Stratton Commission recommendations and has done an enormous amount for the nation. However, in my view NOAA has remained a collection of agencies rather than a lead ocean agency. In some ways, within NOAA there is a mirror of the problem that we found across the federal "ocean" agencies, that is, program fragmentation and conflicting authorities. The National Ocean Policy Act should serve as an organic act, taking the opportunity to strengthen NOAA by drawing programs together from across the government to reduce program fragmentation. It should also take the opportunity to focus NOAA on its core competencies and mandates; assessment, prediction and operations, ecosystem-based management of ocean and coastal areas and resources, and science, research and education. The current NOAA line structure reflects the agencies they were created from rather than the tasks they will need to undertake in the 21st century. Again, I have high regard for the people and mission of NOAA and in many ways feel a part of the agency. But I also know it is hard to change the way business is done without a change in structure because working patterns become set. But as new imperatives come forward, such as the implementation of a new integrated ocean observing system, the implementation of an ecosystem-based approach to management, and increasing demands for research and scientific advice, NOAA must be restructured in order to grow into these programs in stride. To take another example, the Commission recommends as a guiding principle the integration of atmospheric, land and water related science and policy. Unfortunately, the "wet" side of NOAA still struggles to talk to the "dry" side of NOAA.

Restructuring organizations can be a tricky process to say the least. There is still however an urgent need for the overall agency to act as a corporate whole. Several principles must be kept in mind. NOAA must remain a science-based agency as one of its core attributes. Prediction and monitoring functions for weather to climate to ocean observations, or the management functions for ocean and coastal areas and resources including sanctuaries, fisheries, aquaculture or habitat protection rely on the science and research enterprise of NOAA and its external partners. There has been much discussion of separating the research in NOAA from management and operations. As a former NMFS scientist and a former NMFS Regional Administrator and serving on the recently completed NOAA Research Review Team, I strongly believe that research and the provision of the science advice for management and operations must remain together. Separating out research from the advisory functions will leave the other parts of NOAA without the best scientific basis for decision-making. The science advisory function is a fundamental job of the best scientists in the agency as part of the science and research enterprise. Then, if the science and research enterprise is to be structurally separate from management and operations, the linkage between these lines needs to be strong enough to ensure science advice of the highest quality is available to respond to management and operational needs on a timely basis. To put it bluntly, researchers cannot refuse a call for science advice because they are more interested in something else. If this linkage cannot be reliably made then the science and research enterprises must remain within the operational lines.

Overall, I believe there are a couple of clear restructuring options for NOAA. One possibility is to restructure the agency into three lines according to the core functions of ecosystem-based management; operations and prediction services; and scientific advice, research and education. This would require the linkage of science with the other two lines as discussed above. Another alternative is to structure along mission lines, coastal and marine ecosystem services, weather and climate services, research, operations and data services. In this case the research and

science functions would remain distributed across all the lines with the research, operations and data services line serving an integrating function for the science program. Clearly there are other configurations, but to me breaking down some walls is necessary to open the architecture of the agency and create a new NOAA. The budget must then follow this structure and allow programs to be streamlined and consolidated. Such restructuring will then provide the basis for NOAA to grow and strengthen through consolidation of programs from across the government. The end result may be that the stronger, bigger NOAA logically becomes an independent agency, in order to fully meet the challenges of changing ocean policy. The Commission report doesn't recommend an independent NOAA, but as stated in the hearing upon release of the report, that remains an option. It is the function, structure and strength that must be addressed in order to make the decision on the appropriate location and stature for the agency.

A major challenge for governance of ocean activities is changing to a perspective of ecosystem-based management. Ecosystem-based management means managing human activities within a large marine ecosystem in concert, rather than separately, and considering the cumulative impacts of those activities on the functioning of the ecosystem as a whole. The perspective is that the natural system sets the bounds for management, rather than political boundaries. This is because within an ecosystem, effects on one component can logically be expected to impact other components. Therefore, as we seek to manage across the full range of human activities and mitigate their impacts on the natural environment, we need to consider the interactions between different management actions. For example, coastal development interacts with pollution abatement programs and affects the productivity of the coastal ocean in salt marshes and nearshore areas such as along the New Hampshire coast. In other words, fisheries are affected by more than just fishing and pollution is affected by more than just controlling the amount of discharge. Because humans are an integral part of the ecosystem, social and economic impacts are part of the ecosystem-based management perspective.

Ecosystem-based management does not mean that we don't have to manage each of the sectors of human activity. Fishing still needs to be managed to prevent overfishing or restore overfished resources for example. But the management of the fishery should be linked to the management of other sectors to provide a more coherent set of policies. The focus for ecosystem-based management should be to maintain the function of coastal and marine ecosystems including both their goods and services. We want to maintain the ability to harvest fish as goods from the ecosystem, but we want to ensure the ecosystem services provided by overall productivity and ocean health isn't undermined. In other words, we want to enjoy a healthy ocean for many other reasons than just fishing.

In order to implement ecosystem based management five changes are needed; creating regional councils and information management systems, developing the capability for the federal government to manage on a ecosystem basis, structuring science programs to support ecosystem-based management, having an overall set of policy goals to guide the management process and developing a comprehensive offshore management regime to deal with gaps in current management authorities. I have already commented on the needed changes in NOAA to support ecosystem level science and management. For the federal government to have the capability to bring together the various sector activities and mandates, and provide the needed flexibility for ecosystem-based management a stronger NOAA and a National Ocean Council with substantial authority are needed. Regional councils must be developed in order to plan and coordinate across the various sectors of human activities that impact an ecosystem. Large marine ecosystems are generally on a regional scale such, as the Gulf of Maine, or the South Atlantic Bight. Multiple jurisdictions are involved and many types of human activities occur within each ecosystem. The Commission recommends setting up regional councils on a pilot program basis (voluntary with substantial flexibility to start) as planning and coordination bodies. The National Ocean Council needs to facilitate their work. Each region may choose different issues to begin work on ecosystem based management and this flexibility is essential. Further, these activities must be funded in order to foster real change. This means funding data and information management so policy makers have the science to develop management plans, funding ecosystem assessments to bring everyone onto a common footing for planning and impact analysis, and funding the management actions themselves.

Regional ocean councils have a difficult task, fitting together the pieces of management across the sectors. This means, for example, making the fisheries management program work in concert with coastal zone management programs, pollution abatement programs and protected species programs. The goal is management plans that specifically include consideration of the cumulative impacts of all of these ac-

tions, creating a system where they leverage one another. The federal government must provide sufficient flexibility to allow this to happen but also ensure that the primary goal of maintaining functioning ecosystems is met.

Finally, there are major gaps in the current set of authorities for management particularly in offshore (federal) waters. There is no real governance structure for newly emerging activities such as energy production, aquaculture, and bioprospecting to name a few. Also included are specific conservation measures such as marine protected areas. Delineating rights and privileges in offshore areas held in the public trust is complex. For offshore oil and gas there is a well developed management system in place, but for other activities that result in exclusive access to areas there is no such system. Without an overarching policy framework that sets goals for ecosystem-based management, ensures that analysis considers impacts across the sectors and specifically sets criteria for deciding protection or access privileges, development will be poorly managed.

Ecosystem-based management is not some theoretical construct. It is common sense. It means looking at all the parts of the machine to understand how they can work together. The goal is a more effective management system that does a better job of protecting the oceans from unwanted changes and further degradation.

Mr. Chairman and members of the Subcommittee, thank you for the opportunity to testify today. I have only touched on a few of the important issues in the Commission report. I would be pleased to discuss these and other matters with you further at your discretion.

Senator GREGG. I think the essence of a lot of the comments that have been made is the reorganization of the Federal role in oceans policy, specifically how NOAA should be structured, and Dr. Ballard I think touched on it, when you look at NOAA's role versus NASA's role, why does NASA receive so much more in the way of funding and why is its role so much more dominant.

I would be interested in the panel's discussion of what created this historical stepchild treatment of the oceans policy and how do we get—your report has obviously outlined it, but how do we push it to the front burner and get it to the status of what NASA may be or should be?

Mr. BALLARD. Thank you, Senator. There are all sorts of explanations that go back to the very fundamentals on the creation of NOAA and its placement in the Department of Commerce. It was not the recommendation of the Stratton Commission that it be placed in the Department of Commerce.

I think certainly one of the issues is for scientists and explorers to get into outer space, it is not that easy. It is not something you can do on your own. And it required the community to work together, to develop the strength within Congress to develop the funding for NASA so that they could pool their resources and provide that gateway into outer space.

The oceans, for better or for worse, you can get into them pretty easily. And when NOAA was created, there was already a very, very large oceanographic community, both in academia and the Government and private sector; whereas when NASA was created, it was fundamentally the Air Force was the only major player in outer space.

So I think that it is the history of the genesis of the two different programs that has led to why they are so different. I think that there is a lot to be learned from the NASA model; I think it has been extremely successful. And the difficulty is getting the oceanographic community throughout the sectors to see that as a strength as opposed to a weakness.

I am hoping that through the strengthening of NOAA, that it can be successful. But as Andy points out, there is a lot of misgivings

upon the part of other members of the marine community about can NOAA pull that off. I vote to try. I think that the time has come to attempt to strengthen NOAA and to have it be much more competitive in that world; that is my own personal opinion. I don't know where Paul is on that.

Mr. SANDIFER. Bob, I tend to agree with you. There was some interesting politics at the time of the Stratton Commission report, as there always are. And President Nixon at the time, according to the stories I hear on this, simply was not willing to place NOAA where it was originally intended because of personal preferences. So it ended up under the reorganization order being part of Commerce.

I think though the real difference between the development of NOAA as the national ocean agency for this country and NASA has been the lack of a defining crisis. In space, it was the Sputnik crisis, the concern that the Soviet Union was outpacing us in the potential development of rocketry and space-based weapons systems that got the Nation mobilized to really begin investing, and that investment then morphed into a lot of other different areas, but all space based.

In the environmental arena, it was Rachel Carson's seminal text, Silent Spring, that reminded all of us, through my childhood at least, of the tremendous problems of the environment and what awaited us if we didn't take action. And a great number of efforts were made, with the Environmental Protection Agency being one of them.

And I think what the Ocean Commission is trying to say with this report, both our preliminary version and this final 3½ pounder, plus all the appendices, which I have been told by the chairman now brings the total weight of our weighty document to 13 pounds.

Senator GREGG. A small cod.

Mr. SANDIFER. I think what we have tried to do is to tell you, tell the country that we have the same kind of crisis now facing the oceans and it is time for us to step up to the plate as a Nation and deal with it by making the necessary, both investments in science and management and in the structural changes in order to be able to deal with the problems.

It is very clear to us that, as Bob described it, the lungs of the Earth—the oceans produce most of the oxygen we breathe—we are an island nation, every State is an island State in that sense, and we must now pay attention. And this ocean blueprint says that we are in crisis. We are not so far gone that we cannot turn the corner and protect our resources, but we are close. And that is what we hope to do with this message.

Senator GREGG. So do you think NOAA should be a separate agency or should it be within Commerce or should it be a quasiagency within Commerce?

Mr. ROSENBERG. I actually believe that NOAA requires substantial independence. Now, whether that is an independent agency or as in some of the recent legislation I believe that you have cosponsored, uses some of the mechanisms for other agencies, like FAA and PTO and so on, to gain that independence, I think it is essential that NOAA gains some independence as well as gaining some strength. The reason for that is partly the size of the agency and

to bring it together into a coherent whole. It is also partly because of the layering that occurs within NOAA on everything from budgetary decisions to policy decisions.

Having worked in the Fisheries Service, which is the largest regulatory part of NOAA—and incidentally, one of the reasons why it is a little harder for people to like NOAA better than NASA is that it has a regulatory function. The layering that occurs right up through the Department, obviously may be important from a policy perspective, but also hinders the agency in becoming what it needs to be on its own and gaining the profile that it has.

So I believe that it does need to have some independence. But I believe that restructuring of the agency from where it currently exists is also necessary. It is quite difficult to make a fundamental change if everybody is in the same place, in the same job and with the same name as they have had before; sometimes you need to make that change structurally in order to get a change in direction.

Senator GREGG. Assuming we were able to follow through on your report and get NOAA restructured and get the Federal house in order, how do you address the international issue? I mean, the oceans are not a regional, national issue; they are an international issue. You have got the Treaty of the Seas, but what is the process that we should be pursuing in this area to try to address, especially your point, Dr. Ballard, about the artifacts being protected that are out there and proper use of the minerals and the resources that are out there?

Mr. BALLARD. Well, that also goes for fundamental exploration; this is everyone's planet. I think clearly the Deep Sea Drilling Program is a wonderful example of collaboration of many nations to look into the third dimension of our planet as a great model.

NOAA has historically been the spokesperson in many, many international discussions. For example, when we did our first exploration of the mid-ocean ridge, Project Famous, with the French, NOAA was the lead agency, interacting with its equivalency, which was IFREMER.

In fact, we find that other countries prefer that. I was just in Athens a few days ago, working with their equivalency of NOAA, which is the Hellenic Center for Marine Research. Other governments tend to be organized around a central agency. So when it comes to international collaboration, having a strong NOAA will make that even easier.

Mr. ROSENBERG. I agree with Bob, certainly from a science perspective. From a policy perspective, it is also I think imperative to have a lead ocean agency and a clearly identified entity, certainly working with the State Department.

But just as one brief example, I used to be the representative for the United States to several of the international fishery organizations. And there was a meeting of North Atlantic Fishery Ministers to discuss coordinating fishery policy in the North Atlantic. And the United States wasn't invited because they couldn't identify a fishery minister. And so we had this long argument about who was the responsible official.

Senator GREGG. We could have sent Herbie Drake.

Mr. ROSENBERG. Yes. We could have sent Herbie Drake. And I did suggest that I believe at one point.

But we don't have as clear a face internationally as we need to on many of the marine environmental issues.

On the science issues, again we struggle because of fragmentation. And I do think that that is one of the virtues of having, not only a National Ocean Council, but also a much stronger lead ocean agency, that you can make that interaction from a position of greater strength.

Senator GREGG. To get to the fisheries issue, which is critical, what should we do to address that, specifically regionally? But NOAA's problems with fisheries are historic. And probably the most difficult part that we deal with, as Members of Congress, is NOAA's dealing with fishermen and with the rights to fish. How do we address that?

Mr. ROSENBERG. Well, I will start and then Paul perhaps can add some comments. I think, of course, as you well know, Senator, and most of the audience probably knows, it is a little harder to be popular when you're regulating. And so, you know, we wouldn't expect—the Weather Service people receive a service and they are usually happy unless the forecast is wrong. In the Fishery Service, if they are doing their job, they are telling people they can't do things. Unfortunately, that is part of regulation; it is not all of the features.

I think that, first of all, Fisheries need to become less isolated, in a sense, within the agency. It is not simply about managing fisheries; it is also about managing the marine environment. There are lots of other pieces to this puzzle. What do other scientists, as well as other parts of the agency bring to the table in terms of cooperative research, in terms of developing some kind of coherence in how the regulations work.

And having conflicting mandates on marine mammals and habitat protection and management of fisheries itself causes a lot of that friction. So I often use in some of my presentations on ecosystem-based management a chart of the Northeast that shows various closed areas. And, you know, I actually was Regional Administrator when many of those areas were closed and it is hard for me to figure out where you can fish and where you can't because it is so confusing. So gaining the ability to actually put together a coherent plan for the ecosystem as a whole, I think makes a substantial difference.

Bringing fishermen into cooperative research programs, such as UNH working with other partners around New England has done very effectively, I think is incredibly important. I think that the Cooperative Research Program has been very successful. The Commission report recommends expanding it very strongly. I think it is been beneficial for fishermen as well as for the agency, very broadly. And bringing a broader public focus to issues, not only of fisheries, but the marine environment in general, strengthening of Sea Grant, strengthening the ocean education programs also gets over the isolation.

It is easy to focus on, you know, you have a group of the regulated community and the regulators and not very many other people paying attention and that is a really difficult recipe for conflict. If you can broaden out that community a little bit, I think that you

can actually make some better progress and also change the climate quite a bit.

Mr. SANDIFER. I agree entirely with Andy's comments. I would like to return for just a moment, Senator, to your question regarding the international arena. Fisheries in the international arena has always been controversial and will remain so. But the Commission report covers a number of recommendations, specific recommendations dealing with how we would do better in international arenas. And of course, one of these, the first one is the first recommendation from the Commission, made in November 2 years ago, and that was for the country to accede to the Law of the Sea Treaty as soon as possible, and hopefully that will still occur.

But there are a bunch of specific things that the Commission recognizes, international and in some cases just bilateral fisheries agreements where we have responsibilities. We need to completely fulfill our responsibilities, make sure that we are, in fact, at the table. We make a number of recommendations dealing with things such as corals, where it is not just the coral environment or the fisheries that depend on those environments, but in some cases products made from coral that become part of the problem. And we recommend a number of steps that could be taken, one of which would be to establish a better way for us to do business with countries that harvest coral resources by providing some mechanism of incentive for them to protect the resources that we then take advantage of.

The same thing holds in the area of aquaculture, where there is a great deal of interest in this environment and in my background, where we strongly recommend the utilization of the U.N.'s Code of Responsible Fisheries, which includes aquaculture, in not only getting the United States to play by those rules, but getting as many other countries in the world to play by the same set of rules.

So I think what we are recommending in a nutshell would be for us to focus on those international arenas, those international areas, codes of activities where we can agree what is responsible activity for this country and for others and try our best to ensure that all of the countries play by that same set of rules. It creates a level playing field for our fishermen and it improves the market that we generate or we make for imported products. It ensures then that we are, in fact, buying product that would be harvested sustainably in other parts of the world's oceans. So there are a number of those kinds of recommendations in here and I think it is just a matter of do we have the will to step up to the plate.

Senator GREGG. I guess as part of the will question is do we have the structure? In other words, much of what you talk about would fall under the State Department's responsibility. And how do we coordinate effectively the State Department with the agency that has knowledge of this, assuming it is NOAA, in a more effective way?

Mr. SANDIFER. Senator, I think you are absolutely correct. And I believe that the recommendations, both in the report and in pending legislation that you have, that would not only strengthen NOAA and strengthen its responsibilities in this area, but strengthen its response to the State Department and the State Department's, shall we say, willingness to listen to the folks who

know something about the resource and science side. So I think that could be a very, very significant step forward if enacted.

Mr. ROSENBERG. If I could just add one brief note about this. Within NOAA, at least in my experience, there are several international programs. You don't have an international program office; you have about four or five for different lines. And while I can understand well the differences between some of the specific negotiations within the different lines, I think it is symptomatic of NOAA that those international program offices in Fisheries or NOS or the other agencies don't really interact with each other; they operate as if they are separate agencies. So that actually weakens the profile of not only the United States in those negotiations, but also NOAA in the discussions as well.

Often you deal with different people in the State Department, depending on which international program you are sitting in. So I do think, again, there are some structural changes that are needed that relate to the overall structural change, such that it is a NOAA program, not a Fisheries program or an NOS program.

Senator GREGG. Would that apply to pollution also, relative to the EPA?

Mr. ROSENBERG. I think it does. I think in the report we note that there are a couple of cases related to Clean Water Act where, you know, the EPA has one program, perhaps the incentive programs for reducing pollution and NOAA has the disincentive programs for reducing pollution as opposed to pulling them together.

There are issues, both on the science side as well as the policy side, with regard to the Clean Water Act-related functions. Habitat is an excellent example of that. Section 404, responsibilities under the Clean Water Act, cut across at least four or five different agencies. And it is unclear where the lead is on many of the specific actions with regard to habitat. Most often, NOAA has a commenting authority; EPA has the implementing authority; but sometimes it is Army Corps and so on. So that fragmentation means that as opposed to having a coherent sort of task force, you have a little bit, sometimes more than a little bit of tug of war between agencies.

I think that we have identified in the report several opportunities for consolidation of programs that are currently shared between EPA and NOAA, that in many cases that consolidation logically should be within NOAA. In other cases, it might be within EPA. But addressing program fragmentation I think is a critical issue and it does cut across much more than NOAA. So if we only think about restructuring NOAA, then we will have only done a piece of the job.

Senator GREGG. I believe we are running out of time. Which leads me to my last question, which is, if you had the magic wand, what would be the three things each of you would do to make sure that this policy in the oceans blueprint was executed on most effectively, the three top priorities?

Mr. BALLARD. Well, clearly, thanks to you and your colleagues, we have tremendous support in the Senate. We have a lot of work to be done in the House. So my dream would be that the House behaves as the Senate's behaved.

Senator GREGG. Words of wisdom; I have never heard such words of wisdom.

Mr. ROSENBERG. That is a tough act to follow, Bob. Thanks a lot.

Mr. BALLARD. Dream on.

Mr. ROSENBERG. Yeah. Well, the three actions that I would take, the first is I would proceed very strongly with an overall governance structure, as in the bill that the Commerce Committee has developed, which I believe is called the Hollings Oceans Act. I think many of the elements are there from the Commission report. But begin that fundamental governance restructuring that needs to happen.

Second, I believe that we do need to fund the development of regional information programs to enable ecosystem-based management and have clear guidelines for the development of regional programs for ecosystem-based management, so that those solutions come from the region as opposed to being developed by NOAA and handed off to the region.

And that is going to require pulling together a variety of data sources on large marine ecosystems around the country and making that information available in a readily accessible form to managers within the regions so that they can actually work through problems, and that they are working together so it is not fisheries managers in one corner and coastal zone managers in another.

And third, I think that we absolutely need to move forward with recommendations such as those in the NOAA research review, but more broadly for the science enterprise, if you like, of the Nation, in terms of really strengthening our science planning, coordination, and then funding for ocean-related science.

I think the NOAA research review gave a lot of guideposts in that direction in terms of developing real planning and partnerships with universities, but we need to actually implement those things as a high priority activity to create the structure we need to do the science we need.

Mr. SANDIFER. Not surprisingly, after spending 3 years with these guys, I am in complete agreement with both of them. I would really like to see the House of Representatives of the U.S. Congress approach these ocean issues with the same determination and energy and interest that the Senate has.

Beyond that, I think the enactment of a governance structure that results in a NOAA that is really a true national ocean agency in reality as opposed to just name is a significant first step.

Second most important step would be to fund the necessary science, education, and other infrastructure needs that we have identified and this committee has made such a great start on.

And third, I will diverge a little bit from my colleagues and say that not only do we need to move toward ecosystem-based science in management, but the academic community needs to embrace what ecosystem-based science really is and begin training a new generation of scientists and policymakers who understand interdisciplinary sciences, that is cross boundaries beyond traditional disciplines, and are able to converse with scientists in different fields, policymakers in different areas, and translate a variety of scientific advances into practical, everyday applications that normal human beings can use. Thank you, sir.

Senator GREGG. Well, I want to thank the panel. And I think what is obvious to everybody here in the audience and to those who

hopefully will be able to watch this, is that we are incredibly lucky as a Nation to have these types of individuals, their talent, their ability focused on this issue, and as a result, making progress on what is such a critical issue.

You know, you don't have to go very far from here to walk to the edge of the ocean and look out and see what an extraordinarily beautiful sight it is, but how vast it is and how big an issue it is for us as a Nation and as a part of the world to address.

In this blueprint is a way for us to get our Nation on the right track, and if America gets on the right track, hopefully we can lead the rest of the world to the right track.

So you have done an extraordinary job with this Commission. It is something I hope we can take the initiatives and policies that are presented and execute on, and certainly I intend to commit to try to do that.

CONCLUSION OF HEARINGS

And again, thanks to the University of New Hampshire and President Hart for the courtesy of allowing us to use this facility. And I thank our extraordinary panel for taking the time to be here today. Have a great day and thank you all for attending.

[Whereupon, at 10:59 a.m., Monday, September 27, the hearings were concluded, and the subcommittee was recessed, to reconvene subject to the call of the Chair.]

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